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Career Outcomes in a Matched Sample of Men and Women Ph.D.s

An Analytical Report

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Committee on the Education and
Employment of Women in Science
and Engineering

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PREFACE

The status of women scientists and engineers has been the subject of two previous reports by the Committee on the Education and Employment of Women in Science and Engineering, one focused on academe and the second on industry and government. Both of these studies yielded strikingly similar conclusions, outlining a broad pattern of multiple disadvantages for doctoral women scientists and engineers in all fields and all employment sectors. Generally speaking, women were far more likely than men to be involuntarily unemployed and underemployed; they were much less likely than men to attain senior faculty rank or move to management levels, and their earnings not only reflected these differences but were persistently lower even at equal ranks. Women who appeared equal to men in all respects at receipt of the doctorate had less assured careers than men, with slower progress and lower ceilings.

Because such differences might arise for many reasons unrelated to discrimination--among them, for example, women's presumed larger investment of time and energy in marriage and parenting, and their presumed restricted geographic mobility--the Committee proceeded with the present study, which examines in greater detail the career differences of closely matched samples of men and women doctorates in the mathematical and natural sciences, the social and behavioral sciences, and the humanities. The latter fields are included for the first time; employment data on humanists were not available at the time of our earlier studies.

One important factor that had to be omitted from the comparisons in this study is quality. The near impossibility of constructing truly objective measures of an individual's quality has been of concern in many other studies besides those that focus on gender differences. The closest approaches to objective assessments of quality employ various proxy measures such as grade point averages, test scores, rapid completion of a doctorate, earning a doctorate in a highly-ranked (by reputation) department, publication counts as an index of research productivity and citation counts as an index of the influence of that research.

This Committee explored the possible gender differences in the first four of these measures at some length in its first report, concluding that "men and women at receipt of the doctorate are similar in average quality although women have an edge in academic ability as measured by college grades and high school test scores."[1] The problem of assessing relative research productivity and quality of men and women scientists proved more complex, however. Prior studies reported in the literature had yielded variable and even contradictory results, and the Committee stated that it had not found any studies that control for "access to appropriate research facilities, division of time between undergraduate and graduate teaching responsibilities, and especially availability of graduate and other research assistants."[2] After reviewing evidence that high publication rates do not necessarily translate into successful careers for women scientists as they do for men, and that "token" status in a department may depress productivity, the Committee concluded that "until an occasional major research department can assemble at least a critical mass of women faculty . . . we do not believe studies of comparative performance will have much validity."[3]

Since then, additional information has become available which suggests strongly that publication and citation counts as measures of productivity and quality, respectively, must be applied with more than ordinary caution in the special case of sex comparisons. This information concerns the enormous increases in the submission/acceptance ratios of papers authored by women when prepublication reviews were conducted with authors' names deleted; an anonymous review policy was first instituted for papers submitted for presentation at annual meetings of the Modern Language Association, and soon extended by the Board of Directors to all MLA publications because the increase in the ratio to a value proportionate to women's representation in the relevant fields was considered as clear evidence of prior sex discrimination.[4] The concerns raised by these facts clearly apply with particular emphasis to the population of the present study, which includes humanists; given the field distribution of women in the humanities, a large majority of them are likely to be in modern language areas and to be significantly affected.

For a host of what are viewed as compelling reasons, it is customary for referees of scientific papers to know the identity of the author(s); the assumption that such knowledge will not affect the outcome unfairly is central to the functioning of many decision processes in the scientific community. There can be little question that events in the MLA experience cast some doubt on the absolute validity of prepublication review practices in the sciences as well, and hence on those quality judgments that are based in whole or in part on publication and citation data. As a first step toward ascertaining whether there is indeed reason to be concerned about sex fairness in prepublication reviews of scientific papers, it would be useful to gather data on submission/acceptance ratios by sex for papers in several scientific fields and for selected high-quality journals in those fields.

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[1] *Climbing the Academic Ladder: Doctoral Women Scientists in Academe,* National Research Council, 1979, p. 38.

[2] Ibid., p. 87.

[3] Ibid., p. 88.

[4] Mary Lefkowitz, "Education for Women in a Man's World," *Chronicle of Higher Education,* August 6, 1979, p. 56.

Despite all these considerations and because the matching characteristics of our sample suggested that comparisons of publication and citation counts might have some validity for this specific sample, such a study was attempted. Unfortunately, as described in Chapter 6, it proved impossible to carry out.

The elements of quality which the present study cannot address may be precisely the ones on which the judgments that determine an individual's career path are based. This report and its predecessors demonstrate clearly that objective factors alone cannot account adequately for the career differences which exist between male and female Ph.D.s. It does not follow, however, that "quality" differences will do so; that would be true only if it can be shown that quality judgments are free of gender bias.

The Committee expresses its sincere appreciation to the authors, Nancy C. Ahern and Elizabeth L. Scott, for their work on this project.

The study was originally conceived and designed by Dorothy M. Gilford while she was director of human resource studies in the Commission on Human Resources. We take this opportunity to acknowledge not only her instrumental role in this project, but the many other occasions on which she assisted the Committee on the Education and Employment of Women in Science and Engineering during her tenure with the Commission. We also thank William C. Kelly, Executive Director of the Commission on Human Resources, for valuable administrative guidance, and Commission reviewers Lloyd Humphreys and Nancy Milburn for their helpful comments.

Special thanks also go to the National Science Foundation for their support of this study and in particular to Morris Cobern who as program officer offered advice and encouragement.

The report which follows corroborates our earlier findings in virtually every detail; with male and female scientists and humanists closely matched by education, experience, type of employment, and even subfield in many cases, none of the differences we have previously noted in career progress disappear and few diminish. Women remain less likely to be employed although seeking employment, their careers are apt not to develop as fully, and they remain significantly less well paid.

We have called attention to the considerable field differences we find in these factors, and the present study again validates the conclusion that sex disparities vary significantly by academic discipline. This finding is particularly interesting because it suggests forcefully that the disadvantages women suffer have little to do with marriage, family responsibilities, or limited geographic mobility--the traditional and widely accepted explanations for women's less satisfactory career progress--for if they did, there should be no appreciable differences among fields. The conclusion that many disadvantages arise from the traditions of the disciplines themselves (as in the biosciences, for example, where some of the most striking disparities occur) seems inescapable.

The study provides clear evidence that one factor partially responsible in the past for slowing women's careers is no longer applicable: women in the recent Ph.D. cohorts are not significantly more likely than men to interrupt their careers. They must now be counted among the permanently attached members of the work force.

Lilli S. Hornig
Chair,
Committee on the Education and
Employment of Women in Science
and Engineering

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INTRODUCTION

This study was designed to analyze the career outcomes of men and women Ph.D.s. It is based on a sample survey of approximately 50,000 Ph.D. scientists, engineers and humanists conducted in 1979 by the National Research Council. The Survey of Doctorate Recipients has been conducted biennially since 1973 with support from the National Science Foundation, National Endowment for the Humanities, and National Institutes of Health. It is based on a sample drawn from a virtually complete file of individuals receiving doctorates from U.S. institutions during the period 1936-1978. The sample is carefully stratified by sex, field, and other variables so that the individual survey responses can be weighted to estimate population totals and population characteristics.

Many studies indicate a striking contrast in the career outcomes of men and women. However, most analyses sample men and women in a specified employment situation, for example, university and college faculty. Part of the observed differences will be due to the tendency for the women to be younger and their tendency to be less highly educated. On the other hand, women who have not obtained this particular kind of employment or who have been terminated will not appear in the sample. That is, these studies can investigate only those women who have, in a certain sense, already achieved success.

The present study is based on triads consisting of one woman and two men who are matched as nearly as possible according to selected background characteristics such as educational criteria and years of experience. Information on these triads allows us to compare the 1979 employment patterns of a set of men and women Ph.D.s with similar traits. The study provides data on sex-related barriers to the advancement of women in each major field for cohorts of triads who obtained a doctorate beginning in the 1940s and continuing through the two periods 1970-1974 and 1975-1978. The study is designed to determine whether there has been a trend in the discrepancy between the career patterns of men and women during the past decade. The matching removes a large part of the variability between the male and female Ph.D. population, in particular, year of Ph.D. (which is highly correlated with age), field of Ph.D., the granting institution, and race. The matching of the two men to each woman also provides the possibility of estimating the reliability of the observed sex differences. By contrasting the career outcomes of individuals in the same triad, we can search for the causes of the observed differences in achievement for three persons "starting out together."

We are indebted to Dorothy M. Gilford who designed this study as part of a larger project of the Commission on Human Resources, National Research Council.

SUMMARY OF FINDINGS

- This study is based on 5,164 triads of one woman and two men who earned doctorates in the period since 1940 and who responded to a 1979 National Research Council survey. Each woman is matched with two men according to year of doctorate, field of doctorate, reputation of the Ph.D.-granting department, and race. For some analyses, the members of the triads are further matched by number of years of full-time equivalent experience and by current employment sector.

Employment

- As many as 87 percent of the women and 94 percent of the men in the sample who received doctorates in the 1940s and 1950s were in the work force in 1979 (page 15).
- The women who earned Ph.D.s in the early 1970s had a median age of 37 at the time of the survey. About two-thirds of them were married but less than half had children. Very few--only one in ten--of the women with children were not in the work force in 1979 (page 30).
- There is no evidence of "reverse discrimination" in obtaining employment in any cohort. Even for the most recent 1975-1978 Ph.D.s, involuntary unemployment was two and a half times higher for women than for men (pages 42-43).

Rank and Promotion

- Among the academically employed Ph.D.s who were surveyed 20 or more years past the doctorate, 87 percent of the men were full professors compared with 64 percent of the women (page 18).
- The sex differentials in faculty status 10-19 years past the Ph.D. are large and pervasive. For a given pair of one woman and one man with matched characteristics, the man is 50 percent more likely than the woman to have been promoted to full professor (page 25).
- Sex differences in tenure status, after controlling for rank, are significant in certain fields, with the largest discrepancy occurring in the biosciences. Of course, tenure status and rank are highly correlated (pages 17 and 26).
- Among 1970-1974 Ph.D.s, one-third of the women but one-half of the matching men held senior faculty posts. In every field, the distribution by rank was less favorable for women than men, based on their greater concentration among assistant professors and nonfaculty appointees. There is no evidence of "reverse discrimination" (page 32).

- In promotions of junior faculty, women were found to lag behind men, regardless of marital status and presence of children, and whether their work orientation was primarily research or primarily teaching (pages 34 and 37).

- Female assistant professors who changed employers between 1975 and 1979 did not materially improve their status while men who moved did. Women faculty were more likely than men to have changed employers between 1975 and 1979--28 percent compared with 19 percent (page 38).

- For the female Ph.D.s who were generally in their late thirties (i.e., those surveyed 5-9 years past the doctorate), married women with children were just as likely as unmarried women with no children to have senior faculty rank (page 37).

- Overall, women with Ph.D.s since 1975 show a lower rate of faculty appointments than matching men. This is highly variable by field: in psychology, women have a slightly more favorable distribution by faculty rank, whereas in biosciences and the humanities, the male Ph.D.s have fared better (page 45).

- Twenty-five percent of the recent female Ph.D.s hold academic positions that are non-tenure track. The rate for matching males is 15 percent (page 46).

Salary

- Academic women with Ph.D.s prior to 1960 reported earnings that were $3,800 or 11 percent less than those for matching men. Among full professors of chemistry, the sex difference was $5,500 for the matched pair sample--only a slight reduction from the previously reported $6,200 gap where no matching is made (page 17).

- Female salaries at major research universities are significantly below the estimated salaries for men with similar characteristics. The estimations take account of a number of work-related variables, such as full-time status, primary activity, and type of institution of employment, but do not include measures of research productivity (page 54).

- Salary differences between young male and female Ph.D.s in academe still exist, even after controlling for type and quality of doctoral training. The largest differentials in pay for the post-1975 Ph.D.s were found in chemistry ($3,300) and the biological sciences ($2,100) (page 48).

CHAPTER 1

CHARACTERISTICS OF MEN AND WOMEN DOCTORATES

Before comparing the employment profiles of men and women in the matched-pair sample, we will consider the general demographic characteristics of the Ph.D. population and the sex differences based on an unmatched sample.

Doctorates awarded to women

The number of doctoral degrees awarded from U.S. institutions remained fairly steady through the 1950s, began rising sharply from about 1961 through 1971, and has leveled off or dropped somewhat following the peak years of 1971-1972 (Table 1.1). For women in particular, a sharp increase in numbers of Ph.D. recipients occurred during the 1960s but the largest increases have taken place since 1971. In the social sciences, for example, (including sociology, economics, political science, and other fields) the number of Ph.D.s awarded annually to women increased from just over 1,000 to nearly 2,000 during the recent eight-year period. Despite the growth in the last decade, the supply of women doctorates in most physical sciences, mathematics, and engineering fields remains relatively low.

Women's share of all earned doctorates was lowest in the 1950s, which witnessed a postwar baby boom and the return to colleges and universities of a large number of servicemen, many of whom took advantage of the G.I. bill to support their graduate education. Since 1970, the percent of women among Ph.D. recipients has increased significantly: in mathematics, from 8 percent of all doctorates to 14 percent; in bioscience, from 14 percent to 24 percent; and in psychology from less than 22 percent to nearly 38 percent (Table 1.2). The sharpest rate of increase was in engineering, although the number of women receiving engineering Ph.D.s was and still is very small (only 30 U.S. citizens in 1978).

TABLE 1.1 Number of science, engineering, and humanities doctorates awarded to men and women annually, 1940 to 1978

	Men				Women			
	Math, phys sci & engr	Life sciences	Social sciences	Humanities	Math, phys sci & engr	Life sciences	Social sciences	Humanities
1940	1,185	520	254	367	19	71	42	71
1941	987	464	352	376	19	42	59	96
1942	914	617	208	116	44	100	83	93
1943	920	445	132	269	45	22	81	133
1944	541	246	4	133	19	89	71	81
1945	294	169	61	93	13	55	64	111
1946	358	213	187	49	40	68	57	91
1947	948	374	314	581	43	62	60	55
1948	1,177	388	357	317	46	74	61	117
1949	1,912	878	622	510	66	91	96	84
1950	1,824	839	634	766	41	60	85	124
1951	1,892	1,012	937	636	59	140	88	100
1952	2,208	1,103	1,120	746	55	110	102	114
1953	2,043	1,213	1,083	997	80	142	95	110
1954	2,391	1,309	1,185	898	40	72	96	188
1955	2,109	1,432	1,103	832	50	104	119	99
1956	1,721	1,358	1,392	774	62	107	115	133
1957	1,707	918	778	636	41	152	84	168
1958	2,101	1,221	1,303	723	75	172	143	183
1959	2,384	1,287	1,195	981	67	110	167	115
1960	2,284	1,614	1,251	1,049	67	132	140	236
1961	3,202	1,292	1,184	921	68	104	148	199
1962	3,298	1,535	1,501	1,789	104	210	209	322
1963	3,610	1,587	1,315	581	113	146	342	255
1964	3,930	1,746	1,811	1,326	131	224	291	230
1965	5,373	1,888	1,731	1,750	168	256	352	375
1966	5,495	2,120	2,259	1,687	195	262	404	403
1967	6,173	2,534	2,026	2,000	217	408	541	471
1968	5,850	2,479	2,578	1,712	198	546	454	686
1969	7,756	3,236	2,982	2,936	237	394	587	668
1970	7,977	3,457	3,772	2,203	315	490	672	804
1971	7,667	3,785	3,916	3,498	272	634	863	941
1972	8,085	3,681	3,879	3,054	407	708	1,047	1,269
1973	6,964	3,355	4,286	3,137	362	802	1,205	1,372
1974	6,772	3,511	4,194	3,032	409	763	1,503	1,405
1975	6,669	3,475	4,297	2,913	422	981	1,625	1,552
1976	5,636	3,495	4,475	2,733	464	824	1,696	1,542
1977	5,622	3,228	4,350	2,544	441	852	1,759	1,551
1978	5,724	3,358	4,181	2,157	450	952	1,949	1,432

NOTE: Excludes doctoral degrees awarded to non-U.S. citizens who planned to leave the United States following receipt of the degree.

SOURCE: National Research Council, Survey of Doctorate Recipients

TABLE 1.2 Percent of women among doctorates in selected fields, 1940 to 1978

	% Women among doctorates in:								
	Math	Phys	Chem	Engr	Biol sci	Psych	Soc'l sci	Lang & lit	Other human
1940	2.6	6.7	1.4	0.0	14.1	33.9	9.3	19.5	11.0
1945	9.1	11.1	3.6	0.0	31.4	44.4	55.0	54.5	53.8
1950	5.8	1.8	2.7	0.5	8.9	17.2	9.0	16.3	11.4
1955	4.0	2.2	3.6	0.5	6.6	12.8	6.0	14.2	7.9
1960	4.3	1.8	5.0	0.4	10.0	12.0	8.4	23.2	14.8
1965	8.4	2.2	5.3	0.1	15.5	27.1	9.6	23.6	10.8
1970	7.7	2.2	7.7	0.5	14.0	21.6	10.2	33.2	19.8
1975	8.8	5.0	11.5	1.5	26.1	35.1	21.4	43.8	26.2
1978	13.8	4.0	12.6	2.2	24.2	37.8	26.2	49.8	31.7

SOURCE: National Research Council, Survey of Doctorate Recipients

Age and years of prior experience at receipt of doctorate

The median age at receipt of the doctoral degree is similar for men and women, as reported in *Climbing the Academic Ladder: Doctoral Women Scientists in Academe* (National Research Council, 1979). Earlier findings which are reproduced here as Table 1.3 indicate that in some fields, such as math and psychology, women on the average used to be older than men at the time of Ph.D., but that this sex difference has effectively disappeared. In all fields except the humanities, women are now getting their doctorates at the same or a slightly younger age than their male counterparts.

The typical new Ph.D. has had about 3-5 years, on a full-time equivalent basis, of pre-doctoral professional experience (Table 1.4). Assistantships are included. Within particular fields, the median years of experience for men and women is nearly the same.

TABLE 1.3 Median age at receipt of doctorate, men and women doctorates in selected fields, 1967 and 1977

		Math	Phys	Chem	Engr	Soc'l sci	Psych
1967	Men	28.1	28.6	27.7	29.9	29.8	29.8
	Women	29.7	27.5	28.0	*	29.4	31.1
1977	Men	29.1	29.5	28.6	30.0	29.5	29.8
	Women	29.0	29.1	28.2	28.2	29.3	30.0

*Median not computed for fewer than 20 individuals reporting age.

SOURCE: Climbing the Academic Ladder: Doctoral Women Scientists in Academe, National Research Council, 1979, p. 28.

TABLE 1.4 Median number of years of professional work experience prior to the doctorate, men and women doctorates in selected fields, 1970 and 1978

	Math	Phys	Chem	Engr	Biol sci	Psych	Soc'l sci	Lang & lit	Other human
1970									
Men	3.6	3.8	3.2	4.0	3.3	3.5	4.1	4.6	4.4
Women	3.0	3.7	3.7	*	2.6	3.3	3.3	4.7	4.0
1978									
Men	4.4	4.6	3.8	4.6	3.5	3.8	4.6	5.1	4.8
Women	4.2	4.9	4.1	3.8	3.4	4.1	4.4	4.9	4.6

SOURCE: National Research Council, Survey of Earned Doctorates

Prestige of Ph.D.-granting department

There are currently 275 institutions in the U.S. that award research doctorates in one or more science and engineering fields. Only 25 of the universities account for 40 percent of the total doctorate production. To identify the prestige of a department, we will use a set of reputational rankings developed in 1969 known as the Roose-Andersen ratings.

Table 1.5 shows that in mathematics and physics men are somewhat more likely than women to have earned doctorates from the most highly rated departments, while the contrary is true for microbiology and psychology, where women have the higher percentage in the top departments. The male-female comparisons for chemistry and sociology vary from one year to the next; over the 1967-1977 period in general, there appears to be little sex difference in prestige of Ph.D. department.

TABLE 1.5 Number and percent of men and women who earned doctorates from highly rated departments* for selected fields, 1967 to 1977

Field of doctorate		1967 & 1968		1971 & 1972		1975 & 1976		1977	
		Men	Women	Men	Women	Men	Women	Men	Women
Mathematics	No.	865	44	1,039	83	906	87	372	49
	%	50.7	46.3	44.6	43.2	47.0	39.2	44.8	38.3
Physics/ Astronomy	No.	1,390	54	1,535	41	1,077	48	502	28
	%	52.0	76.1	47.0	40.2	44.7	38.4	46.3	43.8
Chemistry	No.	1,633	138	1,740	159	1,335	182	623	68
	%	49.3	53.5	45.2	42.1	44.2	47.5	44.8	37.8
Microbiology	No.	197	65	174	66	156	71	74	31
	%	35.4	47.4	27.2	40.2	29.2	37.2	32.7	36.0
Sociology	No.	287	65	395	104	391	189	191	88
	%	50.5	49.2	40.7	41.1	39.9	43.6	39.1	37.1
Psychology	No.	894	292	1,089	490	1,080	631	501	320
	%	41.4	48.9	33.3	43.2	28.3	34.7	26.7	29.6

*Based on ratings of "distinguished" or "strong" graduate faculty, as reported in Kenneth D. Roose and Charles J. Andersen, A Rating of Graduate Programs, American Council on Education, Washington, D.C., 1970.

SOURCE: National Research Council, 1979, p. 31.

TABLE 1.6 Type of Ph.D. institution attended, men and women doctorates in science, engineering, and humanities (1940-1978 Ph.D.s)

Carnegie classification of institution*	Men	Women
Research university I	66.1%	63.1%
Research university II	19.5	20.2
Other doctorate-granting I	11.8	13.1
Other doctorate-granting II	2.6	3.5

*As found in A Classification of Institutions of Higher Education, Carnegie Foundation for the Advancement of Teaching, 1973.

SOURCE: National Research Council, Survey of Doctorate Recipients

If we examine institutional origins of men and women Ph.D.s by Carnegie classification (Table 1.6), the types of institutions attended are quite similar. About 83 percent of the women and nearly 86 percent of the men earned doctorates from a research university--one of 92 leading institutions in terms of federal support of academic science and number of doctorates awarded annually.

Support during graduate school

Most graduate students finance their education at least partially from sources other than their own or their family earnings. The most common source of financial aid are teaching assistantships. About 50 to 70 percent of the men and women Ph.D.s in recent years were so supported at some time during their graduate training, with the availability of teaching assistantships apparently highest in mathematics and chemistry departments. Research assistantships, which are often viewed as more desirable than teaching assistantships, were reported by similar proportions of men and women. in examining changes in support patterns between 1970 and 1978 (Table 1.7), the most notable shift is the decline in availability of fellowships for both men and women. It should be noted that the sharp fall-off in the percentage so supported during this period, for example from about 60 percent to 36 percent in chemistry, understates the decline in actual number of fellowships available, since enrollments in doctoral programs also dropped during this period.

Of particular interest here is the extent of sex differences in obtaining research assistantships. The research assistant experience, with benefits including familiarity with facilities and equipment, access to research faculty, and exposure to new ideas, is often thought to provide an important link to later independent research. It has also been linked to salary outcomes, and was found by Astin and Bayer (1972), to be a significant predictor variable in regression analyses of faculty salaries. However, in the present data (Table 1.7) we find very little difference in the percentages of men and women who held research assistantships.

TABLE 1.7 Sources of support during graduate school, men and women doctorates in selected fields (Respondents may indicate more than one source, so percents will total more than 100%.)

	Math	Phys	Chem	Engr	Biol sci	Psych	Soc'l sci	Lang & lit	Other human
1970 Men									
Teaching asst.	68%	60%	74%	38%	46%	50%	53%	69%	60%
Research asst.	37	72	57	54	41	47	38	6	14
Fellowship/ traineeship	65	56	60	58	71	68	61	56	61
G.I. Bill	5	4	3	6	6	10	13	13	16
Own earnings	29	18	12	28	19	39	42	42	46
Spouse's earnings	14	12	10	12	15	22	23	24	28
Other	24	19	24	32	21	34	38	38	44
1970 Women									
Teaching asst.	77	73	69	33	41	38	45	60	48
Research asst.	35	78	51	40	32	36	33	8	14
Fellowship/ traineeship	80	59	64	60	92	73	73	60	65
Own earnings	22	15	10	27	14	40	38	39	42
Spouse's earnings	22	17	7	33	10	25	24	24	21
Other	23	15	21	27	16	29	47	39	52
1978 Men									
Teaching asst.	79	67	81	38	52	48	54	71	56
Research asst.	34	78	68	69	48	35	36	9	13
Fellowship/ traineeship	40	38	36	33	53	45	48	47	48
G.I. Bill	9	9	8	7	14	13	15	12	14
Own earnings	40	24	16	36	29	58	54	57	62
Spouse's earnings	22	24	25	22	32	35	33	35	37
Other	32	22	26	33	28	46	45	42	51
1978 Women									
Teaching asst.	77	67	84	40	51	45	51	67	55
Research asst.	33	71	71	73	40	32	35	10	13
Fellowship/ traineeship	39	67	36	40	61	50	52	42	51
Own earnings	36	17	13	36	30	58	53	54	63
Spouse's earnings	32	21	20	36	28	30	31	40	35
Other	28	31	24	29	34	43	46	44	54

SOURCE: National Research Council, Survey of Earned Doctorates

Marital status and plans at time of doctorate

About one half of the new (1978) women Ph.D.s in science and engineering were married at the time of doctorate, compared with two-thirds of the men. Only in physics, and to a lesser extent in mathematics, are the recent women doctorates more often married than the men.

As shown in Table 1.8, marital status appears to have relatively little effect on postdoctoral plans for recent women Ph.D.s. Of those who were married (most of whom were in their late twenties and early thirties), only a very small number (0-3 percent) did not plan to be either employed or on a postdoctoral fellowship immediately following the doctorate. For men, marital status does have one obvious relationship to plans: married men are far less likely to take a postdoctoral appointment than are single men, as was noted in *Climbing the Academic Ladder*. In chemistry, for example, 62 percent of the single men were planning postdoctoral study compared with only 45 percent of the married men.

Labor force participation after the doctorate

More than 92 percent of all women Ph.D.s who have received doctorates in science, engineering, or humanities fields since 1960 were in the labor force as of 1979 (Table 1.9). The only noticeable sex difference in rate of participation is found for men and women in the 1950s cohort. Overall, this group has a lower percentage in the labor force in 1979 due to retirements, although there is no reason to believe that the 79 percent figure for women is due to a disproportionately large number at retirement age.

It should be noted that of the 1975-1978 women Ph.D.s--the group most likely to be temporarily out of the labor force due to caring for young children--less than 7 percent were unemployed voluntarily.

In Table 1.10, we examine any sex differences in full-time versus part-time employment and unemployment rates. About one out of eight women held part-time positions, regardless of age group. The extent of part-time employment among men was slight--less than one out of 40. For all cohorts, the unemployment rate of women (based on those unemployed and seeking employment) is two to four times that for men. A higher unemployment rate for women has also been found when examined separately by field.[1]

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[1] See *Science, Engineering and Humanities Doctorates in the United States, 1979 Profile,* National Research Council, 1980, p. 29. Higher unemployment rates for women than men are also documented in previous *Profile* reports from the biennial Survey of Doctorate Recipients.

TABLE 1.8 Immediate plans at time of doctorate by marital status, men and women doctorates in selected fields, 1970 and 1978

	Math	Phys	Chem	Biol sci	Psych	Soc'l sci	Lang & lit	Other human
1970 Men								
Married	753	1,074	1,448	1,977	1,094	1,643	873	1,325
% Planning empl.	93	62	64	52	87	96	97	98
% Planning postdoc.	7	38	36	47	13	4	2	2
% Other plans	<1	<1	0	1	0	<1	1	<1
Not married	265	323	443	401	242	353	247	323
% Planning empl.	88	50	50	36	83	94	97	95
% Planning postdoc.	11	49	50	63	17	6	3	5
% Other plans	1	1	<1	1	<1	<1	<1	0
Women								
Married	41	22	90	256	249	152	295	170
% Planning empl.	95	59	55	44	84	86	92	86
% Planning postdoc.	0	41	41	52	15	10	4	9
% Other plans	5	0	4	4	1	4	4	5
Not married	27	14	70	190	139	101	220	161
% Planning empl.	96	43	53	40	87	88	97	97
% Planning postdoc.	4	57	46	59	13	12	2	2
% Other plans	0	0	1	1	0	0	1	1
1978 Men								
Married	333	537	757	1,402	1,093	1,447	480	971
% Planning empl.	91	50	55	37	83	94	95	95
% Planning postdoc.	9	50	45	63	16	6	5	5
% Other plans	0	0	0	0	1	<1	<1	<1
Not married	278	335	437	701	555	576	255	496
% Planning empl.	80	37	38	24	76	89	92	92
% Planning postdoc.	19	63	62	76	24	10	7	8
% Other plans	1	0	0	<1	<1	1	1	<1
Women								
Married	58	31	96	394	454	370	407	342
% Planning empl.	93	48	53	32	79	88	90	88
% Planning postdoc.	5	52	44	67	19	11	7	9
% Other plans	2	0	3	1	2	1	3	3
Not married	46	13	82	317	464	303	290	265
% Planning empl.	89	38	45	27	78	88	93	92
% Planning postdoc.	9	62	55	73	22	12	7	7
% Other plans	2	0	0	<1	<1	0	<1	1

SOURCE: National Research Council, Survey of Earned Doctorates

TABLE 1.9 Labor force participation rates as of 1979, men and women doctorates in science, engineering, and the humanities

Year of doctorate	Total doctorates in U.S. population		% In labor force	
	Men	Women	Men	Women
1950-1959	50,791	4,167	93.4	79.2
1960-1969	101,391	11,493	98.6	92.3
1970-1974	90,225	16,243	99.0	93.3
1975-1978	64,857	18,492	98.0	94.6

TABLE 1.10 Employment status in 1979 by year of doctorate, men and women doctorates in science, engineering, and humanities

	No. in labor force	% Of labor force			
		Full-time	Part-time	Post doc	Unempl. and seeking
Men					
1950-1959	47,457	96.6	2.7	0.1	0.6
1960-1969	99,997	96.8	1.9	0.6	0.7
1970-1974	89,278	95.6	2.2	1.4	0.8
1975-1978	63,553	86.0	2.7	9.9	1.4
Women					
1950-1959	3,301	84.6	11.1	1.6	2.7
1960-1969	10,610	84.4	12.0	1.1	2.4
1970-1974	15,153	81.7	12.8	2.4	3.1
1975-1978	17,492	73.6	11.2	10.4	4.8

SOURCE: National Research Council, Survey of Doctorate Recipients

In the following chapters we will examine the career outcomes of men and women Ph.D.s, considering various cohorts within the population described above. The outcome data will be based on information collected in 1979 for a sample of matched male-female pairs.

CHAPTER 2

PAIRED DOCTORATES WHO RECEIVED PH.D.s IN THE 1940s AND 1950s

Previous studies of the status of women in science have shown the largest sex differences in academic rank and pay occur for older women Ph.D.s, who have tended to start at lower salaries and advance more slowly than men. This group is often viewed as the last to benefit from affirmative action mandates. In the following section, we will examine the differences in academic career outcome, as observed in 1979, between men and women in a matched-pair sample who received their Ph.D.s in the period 1940-1959. Chapters 3 through 5 analyze matched pairs of men and women from later cohorts--1960-1969, 1970-1974 and 1975-1978.

The matching procedure

Out of a total sample of 49,671 Ph.D.s from the years 1936-1978, responses were received from 32,877 individuals or 66 percent. For the present report, pre-1940 Ph.D.s (who would tend to be retired) and those residing outside the U.S. were deleted, resulting in a data base of 29,410 individuals, 10,278 women and 19,132 men. An attempt was made to match each woman with two men according to four characteristics: year in which the Ph.D. was received, field of Ph.D., institution from which the doctorate was awarded, and race.

Some flexibility in the matching was necessary. In matching by *year of Ph.D.*, a sliding scale was used for allowable male-female differences. Women doctorates since 1970 were required to have male matches with the same year of Ph.D. or a difference of only one year. Pre-1970 Ph.D.s were allowed a difference of 2-5 years. Matches by *field of Ph.D.* were ideally by specialty (i.e., nuclear physics, polymer chemistry); three-fourths of the males and females used in this analysis were so matched. The other one-fourth do not match by fine field, but are in the same broad field or discipline (e.g., physics, chemistry). Similarly, the *Ph.D.-granting institution* was used for the matching procedure, but when this was not possible, the prestige of the doctorate-granting department, as indicated by Roose-Andersen ratings, was used. The latter requirement posed some restrictions in that the Roose-Andersen ratings of Ph.D.-granting departments are not available for all fields within science, engineering, and the humanities. Thus, the reader will note that the report does not present separate data on men and women in computer sciences or the agricultural sciences.[1] Matching by race was according to four categories: white, Asian, black, and other.

The above procedure produced a set of 5,164[2] triads of one female and two males, or a total of 15,492 individuals. This group, which will be hereafter referred to as "A" matches, is used in the female-male comparisons of labor force participation, part-time employment, and marital status found in the beginning sections of chapters 2 through 5. The numbers of "A" matches within each cohort are as follows:

1940-1959 Ph.D.s	1,119
1960-1969 Ph.D.s	1,512
1970-1974 Ph.D.s	1,288
1975-1978 Ph.D.s	1,245
Total	5,164

A subset of the 5,164 triads, which we will call "B" matches, are in addition matched by 1979 *employment sector* (i.e., academic, government, industry, other) and by number of full-time equivalent *years experience* with a difference not to exceed 5 years. The number of "B" matches are:

Academic sector	2,138
Business/industry	332
Federal government	85
Other	528
Total	3,083

The numbers of matched triads within industry or government, when also controlled by Ph.D. cohort, are generally too small to permit separate analyses of their employment patterns. For this reason, the present report will focus on career outcomes of men and women in academe.[3]

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[1] Engineering and earth science figures are also not reported separately, for reasons of a small sample size rather than unavailability of Roose-Andersen ratings of departments.

[2] This represents 66 percent of the total number of females in the survey sample in Roose-Andersen rated departments.

[3] "Academe" as used in this report includes universities, medical schools, and four-year colleges.

The "B" matches within the academic sector, which include 2,138 triads, are used for the analyses of male-female differences in 1979 faculty rank, tenure status, work activities, faculty promotions, and salaries, found in chapters 2 through 5, and in the regression analyses presented in chapter 6.

Characteristics of the paired 1940-1959 doctorates

The matching procedure described above produced 1,119 pairs of "A" matches of male and female survey respondents from the 1940-1959 cohort, two-thirds of whom are 1950s graduates (Table 2.1). The proportion of married and not married women in the group to be examined is about evenly split. Unfortunately, the information as collected on the questionnaire does not allow us to distinguish between those never married and those who are widowed or divorced. The 52 percent reported here as not married may include a substantial number who are widowed, considering that one-half of the women are age 60 and over.

TABLE 2.1 Characteristics of the 1940-1959 women Ph.D.s in the matched men and women sample

Number of women	1,119
Age in 1979	
45 & under	<1%
46-49	9
50-54	21
55-59	24
60-64	20
65 & over	26
Year of doctorate	
1940-1944	14%
1945-1949	20
1950-1954	28
1955-1959	38
Marital status	
Married	48%
Not married (incl. widowed, divorced)	52

Employment status

Of the matched sample group who are under age 65, about 87 percent of the women and 94 percent of the men (Table 2.2) were employed or seeking employment as of 1979. Part-time employment, while not extensive, is more likely among women (10 percent) than men (3 percent). Examining employment differences by field, we find that in each case, the proportion of women in the work force is lower than that for men but never drops below 80 percent.

TABLE 2.2 Employment status of matched pairs of men and women who earned doctorates in the 1940s and 1950s

	Size of matched-pair sample	Number under age 65	Under age 65 only			
			Full-time	Part-time	Seeking empl	Not in labor force
All fields						
Men	1,119	892	91%	3%	< 1%	6%
Women	1,119	819	74	10	2	13
Math						
Men	82	70	91	3	0	6
Women	82	62	79	10	2	10
Physics						
Men	78	70	90	0	1	7
Women	78	65	74	6	0	20
Chemistry						
Men	134	121	93	2	0	6
Women	134	117	7	10	2	17
Biological sci.						
Men	256	206	88	2	2	7
Women	256	192	67	9	4	18
Psychology						
Men	151	133	89	5	0	5
Womdn	151	120	80	11	1	8
Social sci.						
Men	141	103	91	3	0	6
Women	141	90	81	9	1	9
Languages & lit.						
Men	84	51	92	4	2	2
Women	84	53	81	9	0	9
Other humanities						
Men	130	85	91	5	0	5
Women	130	67	75	12	1	12

Type of position held

The following comparisons of career outcome of men and women are based on the "B" matches as described on page 13. Outcomes will be examined by sector since the job structure and rewards are much different in academic, industrial, and government careers. The "B" matches also control for any large male-female differences in full-time equivalent years of professional experience, a requirement which is particularly important for the older Ph.D. group. For example, without matching we find that among those surveyed 30-35 years after the doctorate, married women generally have accumulated 7-12 fewer years experience than all others (Table 2.3). This is less true for married women who are somewhat younger (20-25 years past the doctorate).

The total numbers of the "B" matches available are shown in Table 2.4. The only sector for which there is a sufficiently large sample for analysis is for those in academe, which here includes four-year colleges, universities, and medical schools.

TABLE 2.3 Median number of years of professional experience (full-time equivalent) as of 1979, compared with elapsed time since Ph.D.

Before matching

		Years FTE experience			
		Men		Women	
Year of Ph.D.	Elapsed time	Married	Not married+	Married	Not married+
1944	35.0 yrs.	37.1	*	30.0	36.6
1949	30.0	32.8	31.6	20.9	31.6
1954	25.0	26.8	24.9	24.6	28.2
1959	20.0	22.2	21.5	19.9	23.7

*Insufficient number of cases for computing median
+including widowed, divorced

TABLE 2.4 Number of matched pairs of men and women who earned doctorates in the 1940s and 1950s, by employment sector

	Number of male/female pairs
Total sample ("A" matches)	1,119
Pairs matched by sector/experience ("B" matches)	
Academic	406
Industry	50
Federal government	25

Most of the academically employed, who were surveyed in 1979--which is 20 or more years after the Ph.D.--were full professors, as one might expect. (Table 2.5) Worth noting, however, is the fact that in the biosciences as many as one-third of the women were still at the rank of associate or assistant professor, as were one-fourth of the women in psychology and literature departments.

Tenure status is also a problem for women in certain fields. Of the women bioscientists with faculty status, 16 out of 78 had not been awarded tenure whereas all of the matching men in the sample had. A statistically significant difference in the proportion tenured was also found among male and female faculty in psychology and language and literature departments (Table 2.6).

Salaries

Large differences in median salaries as of 1979 of the women and matching men were observed. For all fields combined, the women earned $3,800 or 11 percent less each year than the men in the sample (Table 2.7).

Even if the salary comparisons are limited to full professors, the overall sex difference is narrowed but remains significant at $2,700 or 8 percent. The differential in pay exceeds $5,000 for full professors of chemistry and $4,000 for literature professors (including English, classics, and modern foreign languages).

TABLE 2.5 Type of position held by matched pairs of men and women in academe who earned doctorates in the 1940s and 1950s

	Total academic	Faculty	Prof	Assoc prof	Asst prof	Instr	Non-faculty	Other/ no report
All fields								
Men	406	386	354(87%)	29	2	1	3	17
Women	406	351	258(64%)	81	11	1	16	39
Math								
Men	42	40	38(90%)	2	0	0	0	2
Women	42	40	35(83%)	4	1	0	0	2
Physics								
Men	24	20	15(62%)	5	0	0	0	4
Women	24	20	15(62%)	5	0	0	0	4
Chemistry								
Men	30	28	23(77%)	5	0	0	0	2
Women	30	22	14(47%)	7	1	0	4	4
Biological sci.								
Men	93	88	77(83%)	10	1	0	2	3
Women	93	78	46(49%)	25	6	1	6	9
Psychology								
Men	48	45	43(90%)	1	1	0	1	2
Women	48	43	30(62%)	11	2	0	3	2
Social sci.								
Men	58	57	56(97%)	1	0	0	0	1
Women	58	51	42(72%)	9	0	0	1	6
Languages & lit.								
Men	46	45	42(91%)	3	0	0	0	1
Women	46	42	31(67%)	10	1	0	1	3
Other humanities								
Men	48	47	45(94%)	1	0	1	0	1
Women	48	40	33(69%)	7	0	0	1	7

TABLE 2.6 Tenure status of matched pairs of men and women in academe who earned doctorates in the 1940s and 1950s

	Total academic	Number faculty	Number tenured	Percent tenured	Not tenured
All fields					
Men	406	386	379	98%	7
Women	406	351	313	89*	38
Math					
Men	42	40	39	98	1
Women	42	40	36	90	4
Physics					
Men	24	20	18	90	2
Women	24	20	20	100	0
Chemistry					
Men	30	28	26	93	2
Women	30	22	21	95	1
Biological sci.					
Men	93	88	88	100	0
Women	93	78	62	79*	16
Psychology					
Men	48	45	45	100	0
Women	48	43	37	86*	6
Social sciences					
Men	58	57	57	100	0
Women	58	51	50	98	1
Languages & lit.					
Men	46	45	45	100	0
Women	46	42	39	93*	3
Other humanities					
Men	48	47	45	96	2
Women	48	40	36	90	4

*Sex difference is statistically significant at .05 level.

TABLE 2.7 Median annual salaries of matched pairs of men and women in academe who earned doctorates in the 1940s and 1950s

Field of doctorate	All academic positions			Full professors only		
	Men	Women	% Less	Men	Women	% Less
All fields	$34,100	$30,300	11%	$35,000	$32,300	8%
Math	34,000	33,700	<1	35,500	34,200	4
Physics	36,000	31,700	12	34,500	37,000	+7
Chemistry	29,800	25,600	14	30,500	25,000	18
Biological sciences	34,000	29,400	14	35,000	36,000	3
Psychology	37,000	34,200	8	36,500	34,600	5
Social sciences	36,000	31,300	13	38,000	34,500	9
Languages & literature	30,300	27,200	10	31,300	27,000	14
Other humanities	30,000	29,500	2	31,500	29,000	8

It is interesting to note that a $6,200 salary difference as of 1977 for men and women full professors of chemistry was reported in *Climbing the Academic Ladder* (National Research Council, 1979). By repeating the analysis, but this time including only men and women known to have the same characteristics, i.e., pairs matched by race, quality of Ph.D. department, years since doctorate, experience and specialty, the differential was only reduced from $6,200 to $5,500.

CHAPTER 3

PAIRED DOCTORATES WHO RECEIVED PH.D.s IN THE 1960s

As was noted in chapter 1 of this report (see Table 1.1), the 1960s saw a boom in graduate enrollments and Ph.D. production of both men and women. Federal support for training during the post-Sputnik era was generous, with particularly large investments in engineering-related disciplines. During this period, the number of Ph.D.s awarded annually in the physical sciences and engineering more than tripled--from about 2,350 in 1960 to nearly 8,000 in 1969.

More than 50 percent of those receiving doctorates during this decade entered academic employment, with the exception of predominantly industrial employment among chemists and engineers and substantial self-employment among Ph.D. psychologists. The proportions of men and women who took academic jobs are shown in Table 3.1. The only striking sex differences that remain consistent over the 1960-1968 period are in chemistry and physics, with a higher proportion of women in the academic sector, and conversely, their lower representation in industry. Ph.D.s in mathematics resemble humanists and social scientists (excluding economists) more than they do physical scientists in their predominantly academic orientation. Women doctorates in engineering are substantially less likely than men to be employed in academe, reversing the situation in most other science fields.

The group of 1960-1969 Ph.D.s that we will be examining consists of 1,512 pairs of men and women who were selected on the basis of matched characteristics from respondents to a 1979 national survey (as described on pages xv and 12-14). The median age of the women in this sample is 45 (Table 3.2). Thus, the present analyses should provide a profile at mid-career. Most of the pairs are 1965-1969 Ph.D.s. More than half of the women (59 percent) were married as of 1979 but less than half (44 percent) had children. It is interesting to note that the proportion who were married is far below the 80 percent rate for the general female population in the U.S. in the comparable age group.[1]

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[1] Marital status of women age 40-54 as reported in Table 1, Report P20-349, U.S. Bureau of the Census, based on information collected in a March 1979 survey.

TABLE 3.1 The academic market as a percentage of all employment destinations, 1960-1968 Ph.D.s, by field and sex

	1960-1964 Ph.D.s		1965-1968 Ph.D.s	
	Men	Women	Men	Women
Mathematics	68.6%	78.1%	74.5%	78.7%
Physics	48.3	51.2	47.6	58.0
Chemistry	22.9	39.7	26.0	45.4
Engineering	39.7	31.0	34.3	24.1
Biosciences	56.0	66.1	58.8	61.8
Psychology	46.4	47.0	58.0	48.0
Economics	62.1	59.3	64.5	62.5
Other social sci.	71.6	66.3	78.0	77.6
Humanities	87.2	84.0	88.6	84.2

SOURCE: Harmon, 1978, p. 79.

TABLE 3.2 Characteristics of the 1960-1969 women Ph.D.s in the matched men and women sample

Number of women	1,512
Age in 1979	
Under 40	18%
40-44	30
45-49	21
50-54	15
55 and over	16
(median age is 45)	
Year of doctorate	
1960-1964	35%
1965-1969	65
Marital status*	
Married	
Have children	38%
No children	21
Not married	
Have children	6
No children	35

*"Not married" includes widowed, divorced. "Have children" refers to one or more children under age 18.

Employment status

Nearly 95 percent of the women in the sample who were surveyed in 1979 (10-19 years after the Ph.D.) were in the work force. Full-time employment was reported by 82 percent of the women and 95 percent of the men. In each field, women were part-time employed more often than men but the extent of the difference varied considerably according to field: in mathematics, chemistry, social sciences, and humanities, only one out of 18 of the women was part-time employed compared to one in five of the women physicists.

TABLE 3.3 Employment status of matched pairs of men and women who earned doctorates in the 1960s

Field and sex	Size of matched-pair sample	Total in labor force	% of Total: Full-time empl	Part-time empl	Post doc	Unempl. and seeking	Not in labor force
All fields							
Men	1,512	1,490	95%	2%	1%	1%	1%
Women	1,512	1,424	82	10	1	1	6
Math							
Men	136	134	96	1	1	0	2
Women	136	126	86	6	1	0	7
Physics							
Men	97	97	98	2	0	0	0
Women	97	93	73	19	2	2	4
Chemistry							
Men	162	162	95	2	2	1	0
Women	162	155	88	6	2	0	4
Biological sci.							
Men	347	343	95	1	1	2	1
Women	347	319	74	14	1	2	8
Psychology							
Men	155	153	92	5	1	1	1
Women	155	150	85	10	1	1	3
Social sci.							
Men	171	166	94	2	1	1	3
Women	171	166	88	6	1	1	3
Languages & lit.							
Men	135	132	95	1	0	1	2
Women	135	130	87	6	1	2	4
Other humanities							
Men	190	185	94	2	1	1	3
Women	190	176	85	6	1	1	7

Data on earlier employment patterns (Table 3.4) show that nearly all of the individuals in our sample had planned to be employed or on postdoctoral fellowships or traineeships immediately after the doctorate. The suggestion that some of the women Ph.D.s had career interruptions or delays after receiving the doctorate apply to a small minority who indicated "other plans"--only 35 out of 893 women.

TABLE 3.4 Matched pairs of men and women in academe in 1979, and their plans at time of doctorate (1960-1969)

	No. in sample	Planning immediate employment	Planning postdoctoral fellowship	Other plans
Math				
Men	101	93%	7%	0%
Women	101	92	5	2
Physics				
Men	50	66	34	0
Women	50	64	27	9
Chemistry				
Men	65	65	35	0
Women	65	57	34	9
Biological sci.				
Men	183	40	59	1
Women	183	51	47	2
Psychology				
Men	81	74	24	1
Women	81	80	17	3
Social sciences				
Men	128	98	2	0
Women	128	97	1	2
Languages & lit.				
Men	110	97	3	0
Women	110	97	1	3
Other humanities				
Men	133	98	2	0
Women	133	93	2	5

Academic rank and tenure

One measure of the comparative status of men and women in academe is their share of senior faculty positions. Examining the type of position held by field (Table 3.5), we note that 88 percent of the 893 men in the matched-pair sample were professors or associate professors by 1979, whereas only 71 percent of the women held such positions.

TABLE 3.5 Type of position held by matched pairs of men and women in academe who earned doctorates in the 1960s

	Total academic	%						
		Faculty	Prof	Assoc prof	Asst prof	Instr	Non-faculty	Other/ no report
All fields								
Men	893	93	53	35	4	0	2	5
Women	893	85	34	37	13	1	6	9
Math								
Men	101	95	52	38	6	0	1	4
Women	101	95	38	44	13	1	2	3
Physics								
Men	50	80	32	44	4	0	10	10
Women	50	68	20	30	14	4	18	14
Chemistry								
Men	65	85	51	31	3	0	5	11
Women	65	72	22	34	12	5	14	14
Biological sci.								
Men	183	91	42	41	9	0	3	6
Women	183	67	20	34	22	1	12	12
Psychology								
Men	81	91	58	30	4	0	4	5
Women	81	90	31	44	15	0	5	5
Social sci.								
Men	128	98	71	26	1	0	2	1
Women	128	91	54	32	5	0	2	8
Languages & lit.								
Men	110	93	51	38	4	0	0	7
Women	110	89	42	36	11	0	2	9
Other humanities								
Men	133	98	62	35	2	0	1	1
Women	133	94	46	42	5	1	2	5

The sex differentials in faculty status 10-19 years after the Ph.D. are large and pervasive. For a given pair of one woman and one man with matched characteristics, the man is 50 percent more likely than the woman to have been promoted to full professor. In chemistry, bioscience, and psychology the man is twice as likely as the woman to be so promoted (Table 3.6). Moreover, the male professors are twice as likely to be employed in highly rated departments (11 percent) as are female professors (6 percent).[1]

TABLE 3.6 Ratio of number of male full professors to number of female full professors among matched male-female pairs of 1960-1969 Ph.D.s

All fields	1.5
Mathematics	1.4
Physics	1.6
Chemistry	2.4
Biological sciences	2.1
Psychology	1.9
Social sciences	1.3
Languages and literature	1.2
Other humanities	1.3

Of the men and women Ph.D.s who are in senior faculty positions as of 1979, nearly all have been awarded tenure. However, women associate professors lag somewhat behind men in receiving tenure, and the difference is statistically significant in mathematics, bioscience, and social science departments (Table 3.7). The elapsed time from Ph.D. to awarding of tenure is also longer for the women in our sample than the men, for all fields combined (Table 3.8).

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[1] Figures are percent of faculty at given rank who in 1979 were working in departments rated as "distinguished" or "strong" according to Roose-Andersen ratings.

TABLE 3.7 Tenure status of matched pairs of men and women in academe who earned doctorates in the 1960s

Field	Total academic sample		Associate professors			
			No. of	No. of	Percent tenured	
	Men	Women	men	women	Men	Women
All fields	893	893	314	329	91	83*
Math	101	101	38	44	97	80*
Physics	50	50	22	15	82	94
Chemistry	65	65	20	22	100	95
Biological sci.	183	183	75	63	88	73*
Psychology	81	81	24	36	72	53
Social sci.	128	128	33	41	94	85*
Languages & lit.	110	110	42	40	98	95
Other humanities	133	133	46	56	93	95

*Sex difference is statistically significant at .05 level.

TABLE 3.8 Elapsed time from Ph.D. to tenure for matched pairs of men and women in academe who earned doctorates in the 1960s

	Total Academic	Faculty	Tenured faculty	Time-to-tenure			
				4 yrs or less	5-8 yrs	9 yrs or more	Not reported
Men	893	830	770	284 (37%)	345 (45%)	111 (14%)	30 (4%)
Women	893	761	615	192 (31%)	254 (41%)	147 (24%)	22 (4%)

Salaries

Academic salaries for women 10-19 years past the Ph.D. are below the medians for men by 2 to 16 percent, depending on the field. The largest discrepancies in pay are found in biosciences, chemistry, and psychology and amount to $3,500 to $4,500 annually. Not surprisingly, these are the same fields in which wide sex differences in faculty rank were documented (Table 3.5).

In chapter 6, we will examine academic salaries further, utilizing regression analyses to determine the significance of these findings and the extent to which salaries are aligned with various educational and demographic characteristics.

TABLE 3.9 Median annual salaries of matched pairs of men and women in academe who earned doctorates in the 1960s

Field of doctorate	All academic positions		Female salaries less by:	
	Men	Women	$ difference	% difference
All fields	$28,400	$25,500	$2,900	10%
Math	28,200	25,100	3,100	11
Physics	27,400	25,300	2,100	8
Chemistry	27,300	23,600	3,700	14
Biological sci.	28,500	24,000	4,500	16
Psychology	29,500	26,000	3,500	12
Social sci.	31,100	28,400	2,700	9
Languages & lit.	25,800	25,300	500	2
Other humanities	26,900	24,200	2,700	10

NOTE: Includes only those matched pairs in which both the man and the woman are full-time employed.

CHAPTER 4

PAIRED DOCTORATES WHO RECEIVED PH.D.s IN 1970-1974

The sex differences we have examined up to this point concerned women who began their careers prior to 1970. To what extent have employment characteristics of men and women converged for more recent Ph.D.s, and is there any evidence suggesting sex discrimination among young women scientists and scholars? Since the possibility of so-called reverse discrimination is also raised by some observers, we will explore the extent to which this may exist.

First, it should be pointed out that the criteria for selecting matched male-female pairs from this cohort were especially strict. As part of the "A" match[1] within each pair, there is agreement on field of doctorate, quality of Ph.D. institution, race, and year of Ph.D. (within one year). In as many as 85 percent of the 1,316 pairs from this cohort, the man and woman had not only the same field, such as physics or chemistry, but also the same specialty (e.g., nuclear physics, polymer chemistry).

The average year of Ph.D. for the sample is 1972. Therefore, the employment data we will analyze typically describe an individual's situation 7 years after the Ph.D. In terms of academic employment it is thus an appropriate cohort for which to examine tenure decisions.

The women in this group have a median age of 37 (Table 4.1). Two-thirds are married but less than half have children. It is assumed that most of those without children have made final family decisions, since the majority are age 35 or older.

Employment status

Overall, 99 percent of the men and 95 percent of the women were employed or seeking employment in 1979. The majority of the women, regardless of marital status, held full-time jobs. Those who are married and have children have a higher incidence of part-time employment than all others. Relatively few--only one in 10--of the women with children were not in the work force at the time of the survey.

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[1] For details on the matching procedure, see pages 12 to 14.

TABLE 4.1 Characteristics of the 1970-1974 women in the matched men and women sample

Number of women	1,288
Age in 1979	
Under 35	25%
35-39	44
40 and over	31
(median age is 37)	
Year of doctorate	
1970	18%
1971	17
1972	22
1973	21
1974	23
Marital status*	
Married, have children	38%
Married, no children	28
Not married, have children	6
Not married, no children	29

*"Not married" includes widowed, divorced. "Have children" refers to one or more children under age 18.

TABLE 4.2 Employment status of matched pairs of men and women who earned doctorates during the period 1970-1974 by marital status

	Number in sample	Employed		Post-doc	Unemployed	
		Full-time empl.	Part-time empl.		Seeking empl.	Not seeking empl.
Men, total	1,316	93%	2%	3%	1%	1%
Married, have children*	788	94	2	2	<1	1
Married, no children	215	91	3	2	2	2
Not married,+ have children	44	95	2	2	0	0
Not married, no children	147	88	3	4	2	3
Women, total	1,316	78	72	3	2	5
Married, have children	465	65	19	2	4	10
Married, no children	340	82	10	3	2	3
Not married, have children	71	89	11	0	0	0
Not married, no children	359	88	4	4	1	3

*"Have children" refers to one or more children under age 18.
+"Not married" includes widowed, divorced.

Faculty status

As of the 1979 survey, the men and women in this cohort were five to nine years past the doctorate. By this time, most Ph.D.s who are academically employed hope to have a tenured faculty appointment. The period prior to a tenure decision and/or a promotion to associate professor varies by institution. In some cases, a faculty appointment as an assistant professor may carry tenure status. In other institutions a newly recruited associate professor may be ineligible for tenure for the first year or two.

Overall, 43 percent of those in the matched-pair sample of 1970-1974 Ph.D.s had tenure by 1979, reporting an average of 4 years time from Ph.D. to tenure. However, the likelihood of achieving tenure by 1979 was far greater for men than women. Of those who were associate professors, men and women were equally likely to be tenured. Among assistant professors, men were tenured at twice the rate of women, although the percentage was relatively low for both sexes (Table 4.3).

TABLE 4.3 Tenure status of matched pairs of men and women in academe in 1979 who earned doctorates during the period 1970-1974

	Total academic sample		Associate professors		Assistant professors	
	Number	% tenured	Number	% tenured	Number	% tenured
Men	711	52	317	82	233	21
Women	711	35	231	81	280	10

In terms of faculty rank, there were statistically significant differences between the matched men and women in nearly every field. For all disciplines combined, 51 percent of the men were associate professors or full professors by 1979, compared with only 34 percent of the women. In each field (Table 4.4), the distribution by rank is less favorable for women than men, based on their lower numbers of senior faculty, and their greater concentration among assistant professors and nonfaculty appointees. There is no evidence of "reverse discrimination" among the more recent Ph.D.s.

The sex differences in rank are much larger in science departments than in humanities disciplines. For example, the sex ratio of male to female associate and full professors is nearly 2 to 1 in physics and biosciences but only about 1.2 to 1 in social sciences and humanities (Table 4.5). It is also evident that for both men and women, the opportunities for young Ph.D.s to move up in faculty rank were relatively limited in physics, chemistry, and the biological sciences.

TABLE 4.4 Type of position held by matched pairs of men and women in academe who earned doctorates in 1970-1974

	Total academic	Faculty	Prof	Assoc prof	Asst prof	Instr	Non-faculty	Other/ no report
All fields								
Men	711	610	55	317	233	5	56	45
Women	711	559	33	231	280	15	73	79
Math								
Men	56	52	1	38	12	1	3	1
Women	56	53	1	24	26	2	1	2
Physics								
Men	47	28	1	14	13	0	9	10
Women	47	28	0	8	19	1	10	9
Chemistry								
Men	40	31	2	14	15	0	3	6
Women	40	26	0	11	14	1	10	4
Biological sci.								
Men	172	137	4	61	70	2	25	10
Women	172	126	2	33	85	6	33	13
Psychology								
Men	49	43	6	28	9	0	4	2
Women	49	37	3	18	16	0	5	7
Social sci.								
Men	77	71	12	36	23	0	2	4
Women	77	65	8	32	25	0	6	6
Languages & lit.								
Men	100	95	6	50	39	0	1	4
Women	100	84	2	41	40	1	2	14
Other humanities								
Men	119	113	18	56	38	1	1	5
Women	119	102	13	49	38	2	1	16

TABLE 4.5 Percent of men and women in matched-pair sample in senior faculty positions* by field, 1970-1974 Ph.D.s

	Math	Phys	Chem	Biol	Psych	Soc'l sci	Lang & lit	Other human
% Senior faculty* in 1979								
Men	70	32	40	38	69	62	56	62
Women	45	17	28	20	43	52	43	52

*Associate professor or full professor

Since the most notable differences in rank between the matched men and women are in the sex distribution of associate vs. assistant professorships, we will take a closer look at promotions of junior faculty that occurred between 1975 and 1979, and the factors that may be correlated with promotion rates.

Faculty promotions

A number of possible explanations have been offered for the generally lower faculty status of women Ph.D.s: a lower commitment to research or their heavier teaching loads; greater demands of family responsibilities that are assumed to reduce time and performance; a lower degree of geographic mobility because of ties to a spouse's job location.

Many of these assumptions can be tested by the information available. For example, in examining sex differences in promotions between 1975 and 1979 we are able to control for whether or not the faculty member was engaged primarily in research or in teaching at the beginning of this period, whether or not he or she has children, and the extent of inter-institutional moves according to marital status.

It has already been shown that of the 1970-1974 Ph.D.s in a matched-pair sample, the women were less likely to be associate professors in 1979. Looking back at their status four years earlier, we will compare those who were promoted in this period to those who were not.

TABLE 4.6 Faculty promotions between 1975 and 1979 for matched pairs of men and women who earned doctorates during the period 1970-1974

Faculty rank as of 1975	Number		% Promoted to higher rank by 1979	
	Men	Women	Men	Women
Professor	7	1		
Associate professor	57	43	28%	30%
Assistant professor	193	224	62%	44%
Nonfaculty	43	87	47%*	53%*
Total in sample+	300	355		

*Percent who had faculty appointment by 1979.

+Individuals in matched-pair sample who were academically employed and reported their rank in both 1975 and 1979.

There were 300 men and 355 women in our sample for whom 1975 and 1979 information was available. This includes 417 who were assistant professors in 1975 of whom 193 are men and 224 are women. Overall, 62 percent of the men were promoted to associate professor by 1979 compared with 44 percent of the women (Table 4.6).

The women who were primarily engaged in research did not fare any better in promotions than those who devoted most of their time to teaching (Table 4.7). In fact for both the men and women, those reporting teaching as their primary activity in 1975 were more likely to be promoted than all others.

TABLE 4.7 Faculty promotions between 1975 and 1979 by primary work activity for matched pairs of 1970-1974 Ph.D.s

	Primary activity, 1975		
	Teaching	Research	Other
Men (N = 300)			
Professor in 1975	5	0	2
Associate professor in 1975	41	12	4
Promoted to professor by 1979	10	5	1
Assistant professor in 1975	138	52	3
Promoted to assoc. prof. by 1979	88 (64%)	31 (60%)	1
Nonfaculty position in 1975	7	34	2
Faculty appt. by 1979	2	16 (47%)	2
Total in sample	191	98	11
Women (N = 355)			
Professor in 1975	0	1	0
Associate professor in 1975	33	3	7
Promoted to professor by 1979	7	3	3
Assistant professor in 1975	162	53	9
Promoted to assoc. prof. by 1979	77 (48%)	17 (32%)	4
Nonfaculty position in 1975	9	75	3
Faculty appt. by 1979	5	38 (51%)	3
Total in sample	204	132	19

The promotion rates for women also remained comparatively low regardless of marital status (Table 4.8). The married women who had children did better in terms of promotions than unmarried women or those without children. We also have to consider that there may have been more of the unmarried women already at the higher ranks in 1975. But even considering this, the net result was that by 1979, married women with children were just as likely as unmarried women with no children to be at the senior faculty rank (Table 4.9). All groups of women lagged behind men in the percentage at senior ranks.

TABLE 4.8 Faculty promotions between 1975 and 1979 by marital status in 1979 for matched pairs of men and women who earned doctorates during the period 1970-1974

	Married		Not married*	
	Children	No children	Children	No children
Men (N in sample = 300)				
Professor in 1975	3	1	1	1
Associate professor in 1975	39	4	1	4
Promoted to prof. by 1979	11	2	0	1
Assistant professor in 1975	125	35	5	17
Promoted to assoc. prof. by 1979	83 (66%)	18 (51%)	4	9 (53%)
Nonfaculty position in 1975	21	13	1	7
Faculty appt. by 1979	12	4	0	3
Total in sample	188	53	8	29
Women (N in sample = 355)				
Professor in 1975	0	0	0	1
Associate professor in 1975	10	10	2	17
Promoted to assoc. prof. by 1979	5	5	0	2
Assistant professor in 1975	74	63	10	65
Promoted to assoc. prof. by 1979	38 (51%)	26 (41%)	3	24 (37%)
Nonfaculty position in 1975	30	27	2	23
Faculty appt. by 1979	15	15	2	14
Total in sample	114	100	14	106

TABLE 4.9 Net results, 1975 status plus promotions 1975-1979, by marital status in 1979

		Married		Not married*	
		Children	No children	Children	No children
Men					
Total, academic sample		188	53	8	29
Senior faculty	N	129	24	6	14
in 1979	%	(69%)	(45%)		(48%)
Women					
Total, academic sample		114	100	14	106
Senior faculty	N	46	36	5	41
in 1979	%	(40%	(36%)		(39%)

*Including widowed, divorced

Female assistant professors who changed employers between 1975 and 1979 did not materially improve their status while men who moved did. Of those who were assistant professors in 1975 and moved, more than one-half of the men reported a rank of associate professor at the new institution in 1979 compared with one-sixth of the women (Table 4.10).

Women faculty were more likely than men to have changed employers between 1975 and 1979--28 percent did so compared with 19 percent of the men (Table 4.11). We do not know whether the reasons for moving were (1) their initial appointment was short-term and was not renewed, (2) they were denied a promotion, or (3) they were denied tenure. In other words, those who moved may have either responded to a better opportunity elsewhere or may have been "pushed" out. The fact that few of the women assistant professors who moved improved their prospects may indicate that the latter is true. We do know that women were somewhat more likely to have changed institutional affiliation whether by choice or by necessity. This finding casts some doubt on the argument that they are less able to move.

Table 4.11 shows the following patterns for both men and women: Very few of those with a tenured post in 1975 left for an appointment at another institution. In contrast, approximately half of those in off-ladder positions in 1975 had switched employers by 1979.

TABLE 4.10 Employer switches 1975-1979 by matched pairs of men and women in academe who earned doctorates in the period 1970-1974

	Total in sample		Stayed at same institution, 1975-1979		Switched institution, 1975-1979	
	Men	Women	Men	Women	Men	Women
Professor in 1975	7	1	7	1	0	0
Associate professor in 1975	57	43	50	39	6	4
Promoted to professor by 1979	16	13	13	12	2	1
Assistant professor in 1975	193	224	164	174	24	46
Promoted to assoc. prof. by 1979	120	98	103 (63%)	90 (52%)	14 (58%)	8 (17%)
Nonfaculty position in 1975*	43	87	17	36	22	46
Faculty appt. by 1975	24	47	9	14	14	27

*Includes instructors.

TABLE 4.11 Employer switches 1975-1979 by tenure status

	Total in sample		Stayed at same institution, 1975-1979		Switched institution, 1975-1979	
	Men	Women	Men	Women	Men	Women
Faculty status in 1975	312	385	252 (81%)	278 (72%)	60 (19%)	107 (28%)
Faculty						
Tenured	53	38	47	36	6	2
Not tenured	207	243	177	188	30 (14%)	55 (23%)
Nonfaculty	52	104	28	54	24 (46%)	50 (48%)

Prestige of present department

Without considering the type of position held, male and female faculty were equally likely to be located in the more highly rated departments within their field. This is in contrast to the pattern for 1960s Ph.D.s, with men more frequently employed in the top departments (page 26).

TABLE 4.12 Number and percent of 1970-1974 doctorates employed in highly rated departments* in 1979 (by Roose-Andersen rating)

	No. employed all departments+		No. employed highly rated departments		% employed highly rated departments	
	Men	Women	Men	Women	Men	Women
Total academic empl.	607	596	52	64	8.6	10.7
Faculty	522	474	39	36	7.5	7.6
Professor	47	28	1	0	2.1	0.0
Associate professor	270	204	20	12	7.4	5.9
Assistant professor	200	228	18	24	9.0	10.5
Instructor	5	14	0	0	0.0	0.0
Non-Faculty	46	61	12	17	26.1	27.9

*Highly rated departments are those with ratings of 3.0 - 3.9 (strong), or 4.0 - 5.0 (distinguished), as found in Kenneth D. Roose and Charles J. Andersen, A Rating of Graduate Programs, American Council on Education, Washington, D.C., 1970.

+Includes numbers in sample who were employed in fields rated by Roose and Andersen.

Median salaries

For the matched-pair sample of 1970-1974 Ph.D.s, the women had a median salary that was $1,200 or 5 percent below that for men. The salary differential varied considerably by field, with little or no difference in physics, psychology, and social sciences, but a $2,200 gap in biosciences (the field with the largest discrepancy among 1960-1969 Ph.D.s as well).

It should be noted that a salary difference of $1,200 at this early career stage will add up to more than $60,000 over the following 20-year work period. Since salaries tend to go up proportionally, and if we assume an 8 percent annual increase, in 20 years the annual difference in median salary will be $5,600. In the 20 year period, the female member of the pair would have been paid $60,500 less than the male.

Salaries are also considered in chapter 6, which includes regression analyses for male and female faculty at leading research universities.

TABLE 4.13 Median annual salaries of matched pairs of men and women in academe in 1979 who earned doctorates during the period 1970-1974

	All academic positions		Female salaried less by:	
	Men	Women	$ Difference	% Difference
All fields	$22,500	$21,300	$1,200	5%
Math	22,600	21,100	1,500	7
Physics	22,600	22,200	400	2
Chemistry	21,800	20,800	1,000	5
Biological sci.	23,200	21,000	2,200	9
Psychology	22,900	22,600	300	1
Social sci.	22,200	22,600	- 400	- 2
Languages & lit.	20,900	19,400	1,500	7
Other humanities	21,900	20,400	1,500	7

NOTE: Includes only matched pairs in which both the man and women are full-time employed.

CHAPTER 5

PAIRED DOCTORATES WHO RECEIVED PH.D.s IN 1975-1978

By the late 1970s, women were receiving 20 percent of all doctorates in science and engineering and 38 percent of the degrees in humanities.[1] The surge in Ph.D. production for women coincided with a rather tight academic job market. Except in fields such as engineering and computer sciences, the supply of new Ph.D.s desiring faculty appointments exceeded the number of available positions resulting in keen competition for tenure-track slots.

Nonetheless, the number of women on science faculties increased much faster than overall faculty growth between 1973 and 1977.[2] This is the first report that examines the initial employment characteristics of women Ph.D.s since 1977.

As noted in chapter 1, the most recent women doctorates tend to be younger at the time of Ph.D. than their predecessors. As of 1979, the sample of 1975-1978 women Ph.D.s had a median age of 32. Nearly 60 percent were married at the time of the survey; less than one third had children. The largest group of women were not married/no children (38 percent).

Employment status

A recent publication noted 1979 unemployment rates for women Ph.D.s that are two to five times higher than those for men in every field.[3] While this is true for every age category, it is especially a problem for new Ph.D.s. The present report shows that after matching men and women in the survey sample, there is still a higher unemployment rate for women in most fields, with an overall rate two and a half times that for men (Table 5.2). Part-time employment is more common among women than men, but remains fairly low at 5 to 15 percent--a pattern that has been found to hold for all cohorts. There is no evidence of "reverse discrimination" in employment in this cohort or any earlier cohort.

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[1] *Summary Report, 1978 Doctorate Recipients*, National Research Council, 1979, pp. 32-33.

[2] *Climbing the Academic Ladder: Doctoral Women Scientists in Academe*, National Research Council, 1979, p. xiii.

[3] *Science, Engineering, and Humanities Doctorates in the U.S., 1979 Profile*, National Research Council, p. 29.

Overall labor force participation for women is close to 100 percent in all fields but the biological sciences (92%). Among bioscientists there are also a substantial number who were on post-doctoral fellowships or traineeships in 1979.

TABLE 5.1 Characteristics of the 1975-1978 women doctorates in the matched men and women sample

Number of women	1,245
Age in 1979	
Under 30	14%
30-34	53
35-39	20
40 and over	13
(median age is 32)	
Year of doctorate	
1975	23%
1976	25
1977	28
1978	24
Marital status	
Married, have children	27%
Married, no children	31
Not married,* have children	4
Not married,* no children	38

*Including widowed, divorced

TABLE 5.2 Employment status of matched pairs of men and women who earned doctorates during the period 1975-1978

Field and sex	Size of matched-pair sample	% of Total				
		In labor force	Full-time empl	Part-time empl	Post doc	Unempl. and seeking
All fields						
Men	1,245	98	79	3	15	1
Women	1,245	95	68	8	16	3
Math						
Men	77	99	94	1	3	1
Women	77	99	88	6	3	1
Physics						
Men	94	99	78	0	20	1
Women	94	98	60	4	30	4
Chemistry						
Men	121	97	81	2	13	1
Women	121	96	64	6	22	3
Biological sci.						
Men	296	98	56	1	41	<1
Women	296	92	46	3	39	4
Psychology						
Men	104	99	84	5	8	3
Women	104	97	78	13	4	2
Social sci.						
Men	107	99	96	3	0	0
Women	107	97	82	7	4	4
Languages & lit.						
Men	126	98	91	4	1	2
Women	126	95	78	13	0	5
Other humanities						
Men	158	97	83	10	1	3
Women	158	97	78	15	1	3

Academic rank

Table 5.3 shows the type of position held by the matched men and women who were academically employed as of 1979, or one to four years after receipt of the doctorate. About 25 percent of the recent Ph.D.s were in nonfaculty slots, although this category includes mostly postdoctoral fellows and trainees.

TABLE 5.3 Type of position held by matched pairs of men and women in academe who earned doctorates in 1975-1978

	Total Academic	Faculty	Prof	Assoc prof	Asst prof	Instr	Non-faculty	Other/ no report
All fields								
Men	674	450	10	60	365	15	165	59
Women	674	416	3	30	344	39	183	75
Math								
Men	54	47	0	4	39	4	3	4
Women	54	48	0	1	42	5	5	1
Physics								
Men	38	13	0	2	11	0	19	6
Women	38	10	0	0	8	2	21	7
Chemistry								
Men	45	21	0	3	18	0	17	7
Women	45	19	0	1	15	3	24	2
Biological sci.								
Men	178	74	1	6	65	2	98	6
Women	178	62	0	4	52	6	103	13
Psychology								
Men	38	22	0	1	20	1	8	8
Women	38	31	0	1	27	3	2	5
Social sci.								
Men	68	64	2	8	53	1	1	3
Women	68	59	0	6	51	2	4	5
Languages & lit.								
Men	85	75	4	11	58	2	2	8
Women	85	66	0	4	56	6	1	18
Other humanities								
Men	104	94	3	20	66	5	0	10
Women	104	81	3	9	60	9	4	19

Based on equal numbers of men and women in the academic sample, 435 men (65 percent) held positions of assistant professor and above, compared with 377 women (56 percent). Of this group, 70 men and 33 women were senior faculty. While the overall sex difference in percent with faculty appointments is statistically significant, it is smaller than the differences observed for earlier Ph.D.s.

In mathematics, psychology, and social sciences the men and women are not very different in terms of faculty rank, with women having a slightly more favorable distribution by rank among psychologists. The largest discrepancies in proportions of men and women with ladder appointments occur in biosciences and humanities.

Getting on the tenure track

Table 5.3 showed that about 60 percent of the men and women with Ph.D.s since 1975 had regular faculty appointments as of 1979. The majority of these are assistant professorships which are not ordinarily tenured positions; most but not all are tenure-track. Whether or not a junior faculty position is a ladder appointment is sometimes not even known by the individual at the time he or she is hired. The comparative data on tenure status in Table 5.4 indicate that female faculty appointees are nearly twice as likely to be outside the tenure stream.

TABLE 5.4 Tenure status of matched pairs of men and women who earned doctorates during the period 1975-1978

	Total academic sample	Total faculty*	Tenure	Tenure-track	Not tenure-track
Men	674	435	15%	70%	15%
Women	674	377	9%	66%	25%

*Assistant, associate, or full professor

Work activities

The perception that women faculty generally spend more of their time on teaching is borne out by our data on work activities of the recent Ph.D.s but it does not appear to be a serious problem. Before controlling for university setting, there is a slight difference--with 325 out of 447 women (73 percent) spending more than half of their time teaching, compared with 324 out of 485 men (67 percent). It is interesting to note that any differences that do exist are not found in major research universities but in other universities and four-year colleges (Table 5.5). In no setting, however, are the matched men and women very different with respect to the fraction of time devoted to teaching.

TABLE 5.5 Percent time devoted to teaching by type of institution* for matched pairs of men and women who earned doctorates in the period 1975-1978

	Total academic sample	% Time teaching in present position				Total reporting
		<25%	25-49%	50-74%	≥75%	
All institutions						
Men	682	73	88	161	163	485
Women	682	60	62	141	184	447
Research univ. I						
Men	176	14	24	46	24	108
Women	209	15	26	49	33	123
Research univ. II						
Men	77	11	15	27	12	65
Women	73	6	8	25	18	57
Other univ., med sch.						
Men	303	44	38	61	51	194
Women	265	33	24	36	54	147
4-yr. colleges						
Men	126	4	11	27	76	118
Women	135	6	4	31	79	120

*Carnegie classification

Salaries

Even among a matched-pair sample of recent Ph.D.s, the median salary in 1979 for women in full-time academic jobs is lower than that for men by $400 to $3,300 annually, depending on the field. The largest differentials in pay were found in chemistry ($3,300) and the biological sciences ($2,100). There is no evidence of "reverse discrimination" in either rank or salary.

TABLE 5.6 Median annual salaries of matched pairs of men and women in academe in 1979 who earned doctorates during the period 1975-1978

Field of doctorate	All academic positions		$ Difference	% Difference
	Men	Women		
All fields	$19,400	$18,500	$900	5%
Math	19,300	18,900	400	2
Physics	22,700	21,500	1,200	5
Chemistry	21,500	18,200	3,300	15
Biological sci.	20,500	18,400	2,100	10
Psychology	19,100	18,500	600	3
Social sci.	20,100	19,200	900	4
Languages & lit.	17,400	16,600	800	5
Other humanities	18,800	17,400	1,400	7

NOTE: Includes only matched pairs in which both the man and woman are full-time employed.

CHAPTER 6

COMPARISON OF FACULTY SALARIES AND RANK

In chapters 2 through 5, we examined the career attainment of successive cohorts of men and women who were matched in pairs so that they "started off together" at the doctorate. The pattern of observed differences in attainment persisted through the decades. In this chapter, we try to summarize the differences and to examine the factors that appear to be associated with attainment in academe, as measured by rank and salary. Attention is restricted to members of the matched triads employed in academe in 1979 since this is the only large group from the viewpoint of employment sector, and the factors determining achievement are expected to depend on the sector. All three members of the triad are considered for possible inclusion.

Prediction equations are established to estimate first rank and then salary as a function of the characteristics of the individual. We can then contrast the attainment in rank and in salary for men and women who have similar characteristics and the relative importance of the various characteristics for each sex. Lastly, we estimate what salary a woman would receive if she were paid like a man of similar characteristics.

Some information on the factors related to career attainment is available in chapters 2 through 5 from the direct comparisons of members of the triads in successive cohorts. Further information is available from published studies[1] of the status of men and women in academe. Unfortunately, the data set available to us does not contain all the information desired for all years of Ph.D. Certain demographic data, such as marital status at the time of doctorate, which has been shown to have a differential effect for men and women (positive for men, negative for women), are available starting in 1958. Since it is of interest to investigate the importance of such variables, we restrict the data set to those triads where the Ph.D. was awarded since 1958 and to members of the triad who supplied the needed demographic and employment information. We emphasize that the one woman and two men within each triad match not only on characteristics at the time of doctorate but also on number of years of full-time equivalent experience since the doctorate. In the salary studies, full-time employment (in academe) in 1979 is a further requirement for inclusion in the study, because the part-time employment information is incomplete. Since women may be more likely[2] than men to have breaks in employment, to be employed part-time, and/or decline to state their salary, insofar as such persons receive lower rewards, we may be introducing a bias in our conclusions by these restrictions on the sample. As noted earlier in this report, such effects are not expected to be large but we have not had time to examine them in detail.

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[1] cf. Astin (1969), Ferber (1978, Scott (1977) for further references.

We also lack information on publications by each individual. Citation data was desirable, however, the confusion on the identity of individuals in the data bank prevented its use. Investigation of the proposed matching of our sample cases with the ISI (Institute for Scientific Information) data files revealed a large percentage of multiple names in the Ph.D. group caused by the abbreviated form of the names in the ISI author index (two initials and the last name only). The matching problem is exacerbated in the case of women due to cross-referencing of names. Funds were not available for the necessary editing that would permit use of the data.

At first sight, the lack of publication and citation information appears to be a barrier to obtaining good predictions of rank and salary in academe. However, there are two situations where no difficulty seems to arise. Earlier studies [3] indicate that if attention is restricted to faculty in the same or neighboring departments (or fields) and also to the same type of institution, then salaries (rank) may be well estimated without additional reliance on the publication records. This empirical fact was first noticed for male faculty in major research universities[4] in a search for efficient estimators of faculty salary. It appears that the explanation lies in the strong pressure applied in selecting and advancing these faculty; those at the same number of years since the doctorate have very similar salary (rank-step) and rather similar publication records (or they would not be employed in these institutions). Thus, number of years since the doctorate is the most important predictor of salary (rank), and the highly correlated publication information does not improve the precision appreciably.

More recent evidence indicates that if one keeps the data set homogeneous with respect to both field and type of institution, the publication records of women are comparable or even exceed those of men.[5] However, when the data are grouped, confounding arises. Women tend to enter fields, such as the humanities, where the actual number of publications will be small, and they tend to find employment in institutions where research is not encouraged or even possible. If the data are grouped and the confounding ignored, misleading conclusions may result.[6] A further reason for avoiding use of publication records is the fact that insofar as women have excess difficulties in gaining publication due to biased refereeing,[7] use of a woman's publication record will tend to underestimate her rank and salary.

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[2] cf. Chapter 8.

[3] cf. Scott (1977).

[4] Research Universities I according to the Carnegie Classifications.

Another situation where publications records are not needed to estimate salary (rank) of faculty is in the many four-year colleges and universities where research is not emphasized.

In our first analysis, we have restricted attention to members of the triads employed in major research universities in 1979 for several reasons. First, this group of 51 institutions is the largest employer of Ph.D. scientists, engineers, and humanists; second, the reward structure is similar in this set of employers, at least within the same major fields; and third, as noted above, salary may be well estimated without additional reliance on publication records provided the major fields are studied separately.

Our second set of analyses considers full-time faculty in all four-year colleges and universities. Comparison of the two analyses indicates remarkably similar conclusions, differing only in occasional degree, and suggests that the interpretations are indeed not too dependent on the missing publication information. Nevertheless, we would feel more secure if analyses with publication information (or other productivity measures) included had been performed.

With these reservations, we now employ regression analysis to predict first rank and then salary of male faculty, restricted as to field and type of institution. Once these equations have been estimated, we will use them to predict what rank (salary) a woman faculty member would receive in the same field and type of institution if she were rewarded like a man of similar characteristics. We will also estimate prediction equations separately for women faculty members since it is of interest to contrast the importance of particular variables in estimating the reward of women compared to the variables important for men. The prediction equations are also estimated for both sexes combined, with an additive term inserted to portray the effect of sex (the effect of being a woman as contrasted with being a man, all else being constant). This prediction equation will be suitable if the difference in rank (salary) is concentrated in this single additive term (which turns out not to be the case). Lastly, we estimate the prediction equations for rank and for salary for the combined population omitting the sex term. The latter model would be appropriate if sex does not play a role in the determination of rank and salary which, a fortiori, is not the case with our data set.

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[5] Luis Fernandez, "Faculty publications as a stochastic process," *Reports of Carnegie Commission on Higher Education* (forthcoming)
Rita J. Simon, Shirley M. Clark, and K. Galway, "The Woman Ph.D.: A Recent Profile," *Social Problems*, Vol. 15 (1967). pp. 221-236.

[6] cf. Alan E. Boyer, "College and University Faculty: A Statistical Description," *ACE Research Reports*, 5 (5), American Council on Education, Washington, D.C. 1970.

[7] Mary R. Lefkowitz, "Education for Women in a Man's World," *Chronicle of Higher Education*, August 6, 1979, p. 56.

Separate analyses are carried out for the four major fields: 1) mathematics, physical sciences, and engineering, 2) biosciences, 3) psychology and social sciences, and 4) humanities. Recall that we have restricted the population to be analyzed so as to obtain more homogeneous groups in order to improve the validity of the analyses and to clarify the interpretation of the role of sex in the reward system. On the other hand, we are not studying all matched pairs of doctorates. The persons omitted from consideration are more likely to be women than men and will tend to have lower salaries when the reason for removal is unemployment, part-time employment, breaks in employment, and so forth. When the omission is due to employment in another sector than academe, the missing person is more likely to be male and to have a higher salary. Another source of bias is the exclusion of doctorates awarded before 1958, since salary and rank differences tend to be more pronounced for older women. In summary, we can expect to obtain good estimates of the differences attributed to sex for the younger faculty in major research faculties, but expect to underestimate the differences for all matched pairs, especially the older pairs.

Insofar as the regression equations are satisfactory for predicting rank (salary) for any particular group, we can examine and contrast the factors that are important in the prediction. As noted above, the results of the regression analyses can also be used to predict the rank (salary) that a woman should receive if rewarded like a man of similar abilities and experience. If the actual rank (salary) is less than what she would receive if paid like a man, then she has an apparent salary deficit. If the majority of women appear to have a salary deficit, so that their average residual is negative rather than zero (as it must be for men due to the regression analysis), the suggestion is that there may be discrimination against women as individuals or as a class. However, other interpretations could be possible considering the inadequacies of the data set. Moreover, if the regression equations for men's rank (salary) are not satisfactory, we cannot come to any conclusion.

A further way to utilize the sample data from the matched triads is to analyze the salary differences, and the rank differences, within the same triad. It may be, for example, that the important factors creating differences in salary and/or rank vary across fields or across time periods.

Predictors of faculty rank at research universities

Rank was coded as: 4 = full professor, 3 = associate professor, 2 = assistant professor, and 1 = instructor. A linear regression equation to predict rank was estimated by the method of least squares. In the first series of analyses, the possible predictor variables were introduced stepwise in the order of their partial correlation with rank, with the variables already introduced held constant. When the squared correlation coefficient R^2, adjusted for sample size, reached its maximum, the insertion of additional predictor variables was terminated. Thus, the details of the linear regression equation were determined by the data themselves. The sample sizes for the individual prediction equations are not large so that the precision of estimating the coefficients in each equation is not high and the estimators of F* and of adjusted R^2 tend to be deflated. Therefore, a comparison of the coefficients is difficult, and might be better achieved if the same set of predictor variables had been used in every equation.

Nonlinear models, in particular, multiplicative models, could have been investigated also but shortage of time and funds have precluded such studies in this report. Since we have restricted our time interval to 1958-1978 in order to have a fuller set of predictor variables, the consequences of using an additive model versus a multiplicative model are diminished. As indicated in the plots in Chapters 7 and 8, simple linearity is not contradicted especially in the more recent cohorts.

We need to keep in mind that no term measuring standard academic productivity, such as number of research books published and reviewed favorably, has been included due to lack of information. Therefore, the interpretation of the coefficients, especially the less important coefficients, is subject to doubt whenever part of their effect might be absorbed in a measure of productivity.

Tables 6.1 through 6.4 show the factors that predict rank for each of the four major fields. The important predictors are listed in the first column followed by the coefficient to be attached to that predictor, first the ordinary (raw) coefficient to be used in the prediction equation and then the standardized coefficient. The coefficients in the equation predicting the ranks of women are listed first, followed by the coefficients in the equation for predicting the ranks of men, then for both men and women, with the sex term included and with the sex term out of the equation. The third block in Tables 6.1

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*The F-ratio is an approximation to the ratio of the variation explained by a given term relative to the total variation.

TABLE 6.1 Predictors of faculty rank at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of mathematics, physical sciences, and engineering

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined
Years since doctorate	.039	.122	.083	.079	.242	.747	.497	.476	2.98	243.36*	36.23*	31.57*	.57	.79	.72
Years FTE experience	.058	--	.028	.032	.396	--	.199	.229	8.06*	--	6.02*	7.63*	.57	--	.68
Employed in med. school	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Roose-Andersen rating of Ph.D. dept.	.118	.031	.050	.054	.186	.045	.073	.079	4.82*	1.02	3.37	3.74	.18	.07	.10
Married at doctorate	--	-.126	-.132	-.117	--	-.067	-.070	-.062	--	1.99	2.78	2.09	--	.04	.01
Married as of 1979	-.305	--	--	--	-.169	--	--	--	3.57	--	--	--	-.09	--	--
Have children under 18	.168	.222	.206	.256	.100	.123	.115	.143	1.21	5.92*	6.76*	10.12*	.05	.40	.32
Bachelor's from:															
Liberal arts coll. I	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Research university	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Foreign institution	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Constant	1.180	1.508	1.514	1.348											
Sex is female	--	--	-.310	--	--	--	-.163	--	--	--	16.89*		--	--	-.25
R^2	.419	.640	.578	.553											
Adjusted R^2	.386	.633	.569	.545											
Number of cases	94	195	289	289											
Std. error of prediction	.651	.534	.585	.601											

*F > 3.84, nominal 0.05 significance level

TABLE 6.2 Predictors of faculty rank at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of biosciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	.069	.105	.098	.094	.451	.603	.569	.549	11.81*	73.34*	89.57*	75.16*	.62	.73	.69
Years FTE experience	.021	.021	.020	.021	.170	.137	.138	.146	1.63	3.89*	5.29*	5.49*	.58	.66	.62
Employed in med. school	-.263	-.181	-.197	-.212	-.145	-.097	-.104	--	4.29*	6.78*	10.07*	11.23*	-.17	-.08	-.11
Roose-Andersen rating of Ph.D. dept.	.044	--	--	.027	.074	--	--	.039	1.09	--	--	1.37	.15	--	--
Married at doctorate	-.132	.068	--	--	-.088	.034	--	--	1.51	0.66	--	--	-.19	.10	--
Married as of 1979	--	--	.092	.152	--	--	.045	.074	--	--	1.72	3.51	--	--	.12
Have children under 18	--	.124	---	.092	--	.065	--	.053	--	2.32	--	1.69	--	.25	--
Bachelor's from:															
Liberal arts coll. I	--	--	--	-.142	--	--	--	-.052	--	--	--	2.41	--	--	--
Research university	--	--	.058	--	--	--	035	--	--	--	1.11	--	--	--	.12
Foreign institution	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Constant	1.697	1.558	1.684	1.469											
Sex is female	--	--	-.313	--	--	--	-.169	--	--	--	23.94*	--	--	--	-.20
R^2	.429	.559	.532	.512											
Adjusted R^2	.405	551	.526	.504											
Number of cases	126	332	458	458											
Std. error of prediction	.583	.559	.571	.595											

*F > 3.84, nominal 0.05 significance level

TABLE 6.3 Predictors of faculty rank at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of psychology and social sciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	.067	.116	.097	.098	.438	.751	.627	.628	11.77*	233.58*	61.92*	61.35*	.68	.77	.74
Years FTE experience	.038	--	.016	.016	.298	--	.119	.124	5.55*	--	2.24	2.41	.66	--	.66
Employed in med. school	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Roose-Andersen rating of Ph.D. dept.	--	.051	--	--	--	.073	--	--	--	2.21	--	--	--	13	--
Married at doctorate	-.166	.265	--	--	-.097	.105	--	--	1.74	4.21*	--	--	<.01	.15	--
Married as of 1979	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Have children under 18	--	.228	.140	.134	--	.113	.077	.102	--	4.88*	3.10	5.93*	--	.21	.11
Bachelor's from:															
Liberal arts coll. I	.300	--	.161	.141	.126	--	.056	.049	3.00	--	1.77	1.36	.17	--	.06
Research university	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Foreign institution	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Constant	1.785	1.310	1.762	1.673											
- - - - - - - - - - - -															
Sex is female	--	--	-.137	--	--	--	-.076	--	--	--	2.94	--	--	--	-.16
R^2	.518	.625	.565	.560											
Adjusted R^2	.499	.615	.557	.553											
Number of cases	100	162	262	262											
Std. error of prediction	.605	.550	.588	.590											

*F > 3.84, nominal 0.05 significance level

TABLE 6.4 Predictors of faculty rank at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of humanities

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined
Years since doctorate	.081	.086	.081	.079	.533	.559	.518	.508	15.44*	44.16*	54.72*	52.59*	.78	.79	.79
Years FTE experience	.035	.033	.036	.038	.288	.278	.300	.320	4.49*	10.70*	17.85*	20.88*	.75	.73	.75
Employed in med. school	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Roose-Andersen rating of Ph.D. dept.	.077	.037	.060	.061	.120	.051	.084	.086	2.05	1.02	4.25*	4.40*	.26	.01	.08
Married at doctorate	--	.159	--	--	--	.087	--	--	--	3.12	--	--	--	.12	--
Married as of 1979	.293	--	.191	.210	.194	--	.109	.120	6.15*	--	6.91*	8.61*	.30	--	.24
Have children under 18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bachelor's from:															
Liberal arts coll. I	--	-.135	-.096	-.114	--	-.063	-.048	-.057	--	1.62	1.37	1.96	--	-.14	-.13
Research university	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Foreign institution	-.305	--	--	--	-.108	--	--	--	1.65	--	--	--	<.01	--	--
Constant	1.065	1.423	1.303	1.244											
Sex is female	--	--	-.119				-.068	--	--	--	2.55	--	--	--	-.23
R^2	.724	.665	.689	.685											
Adjusted R^2	.694	.653	.680	.677											
Number of cases	53	144	197	197											
Std. error of prediction	.415	.452	.442	.444											

*F > 3.84, nominal 0.05 significance level

through 6.4 shows the F-ratio which is a measure of the importance of the particular effect. Those F larger than 3.84, the nominal 0.05 significance level, have been marked by an asterisk. Many of the predictor variables used are collinear so that neither the coefficient nor the F-ratio has a simple meaning.

The most important predictor variable turns out to be the number of years in academe, or a similar weighted measure of the passage of time. Without exception, the number of years since the doctorate[8] actually possesses the highest correlation (and thus is the first predictor to enter the equation), has the highest standardized coefficient and also the highest F-ratio. However, years since the doctorate and years FTE (full-time equivalent) experience are highly correlated so that the concept of number of years of service is split in most cases, partly absorbed by each of these predictors. The sum of the two coefficients attached to years since doctorate and years FTE experience estimates the average yearly increase in rank. Without exception, the total of these two coefficients for men is larger than that for women, indicating that men advance more rapidly than women, on the average.

For men, the second most important predictor out of those available turns out to be the presence of children under 18 years of age; its coefficient is always positive whenever the term occurs, and indicates an increase in the predicted rank of between 0.1 and 0.25. Having children under 18 has a similar positive contribution to rank for women in MPE fields (mathematics, physical sciences, and engineering) but does not appear in the other fields. Other variables that enter the prediction of rank for most fields include marital status at the time of Ph.D. Being married at receipt of the doctorate makes a negative contribution for women but a positive contribution for men with the exception of men in MPE. Married as of 1979 is collinear with married at time of doctorate so that in most cases only one of these predictor variables enters the equations for rank. The prestige of the Ph.D.-granting institution often enters, always with a positive sign and somewhat more important for women than for men or for both sexes combined. The type of college which granted the bachelor's degree, classified broadly, occasionally plays a small role.[9] For doctorates in bioscience, being employed at a medical school always makes a negative contribution to rank, indicating that the rank structure in medical schools is lower than that in other institutions by about one-fifth of a rank (even more for women).

The predictor variable, sex is female, can enter only in the prediction equation computed for both sexes combined and including the sex term. We note that the effect is always negative and usually important. For example, women in the biosciences are predicted to be about one-third of a rank lower than the matching men. However, since the coefficients of the prediction equation for women are different from the corresponding equation for men, the equation for the combined sample does not apply and can be considered at most a suggestion.

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[8] For women in MPE fields (mathematics, physical sciences, and engineering), this statement applies to years FTE experience.

[9] Due to the very broad classifications used, the effect of baccalaureate origin is not fully known.

Predictors of rank of faculty at four-year colleges and universities

The second set of analyses uses the results of the first analyses to establish a fixed set of predictor variables to be used throughout. Further, in order to increase the sample size and extend the investigation beyond the major research universities, the sample was enlarged to include faculty at all four-year colleges and universities. The number of triad members studied in the second analyses is three to four times that in the first, but the sample is less homogeneous with rather different criteria for advancement. Information on publications is still lacking but does not play a role in many of these institutions. Nevertheless, the goodness of fit is hardly affected, with the adjusted R^2 little changed, sometimes higher and sometimes less; similarly for the estimated standard error of prediction.

The results for the second set of analyses are shown in Tables 6.5 - 6.8 which are to be compared with Tables 6.1 - 6.4. Both years since doctorate and years FTE experience are important. As noted earlier, the sum of their coefficients is an indication of the average increase in rank per year, and this sum is consistently smaller for women than for men. The depressed scale in the medical schools is again apparent. Having children under 18 tends to increase the rank of men, as it does for women in the MPE fields (mathematics, physical sciences, and engineering)--in agreement with the pattern for research universities--but decreases the rank of women in other fields. No other predictor variable seems to be consistently important except the effect of female sex in the combined regression equation which is again negative.

Predictors of faculty salaries

Faculty salaries were estimated by two sets of analyses--first, for major research universities and secondly, all four-year colleges and universities--in parallel with the studies of rank. The important predictor variables turned out to be much the same, except that several additional predictors, some of which are not surprising, affect salary. The salaries to be estimated are the basic annual salaries reported in the Spring 1979 survey (in dollars) for full-time faculty. Salaries reported for a 9-10 month period were adjusted to a full-year scale.

TABLE 6.5 Predictors of faculty rank at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of mathematics, physical sciences, and engineering

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	.068	.083	.077	.075	.426	.530	484	.471	33.22☆	99.92☆	132.94☆	123.20☆	.68	.77	.73
Years FTE experience	.037	.031	.034	.036	.301	.241	267	.276	15.69☆	21.24☆	40.92☆	42.84☆	.66	.73	.70
Employer:															
Four-year college	.021	.051	.035	.026	.012	.028	019	.014	0.08	1.10	0.73	0.40	.13	.00	.04
Research univ. I, other than medical school	-.090	.014	-.018	-.006	-.042	.008	-.009	-.003	1.04	0.08	0.17	0.02	-.13	-.05	-.06
Medical school	-.524	-.435	-.483	-.528	-.153	-.085	-.113	-.123	15.26☆	11.94☆	29.50☆	34.58☆	-.16	-.07	-.12
Roose-Andersen rating of Ph.D. dept.	.005	-.013	-.110	-.009	.001	-.022	-.019	-.014	0.00	0.71	0.75	0.43	-.06	-.06	-.06
Married at doctorate	.056	.008	.026	.035	.033	.005	.015	.020	0.50	0.03	0.37	0.67	-.05	.09	.06
Married as of 1979	-.075	.089	.013	.034	-.043	.039	.007	.017	0.83	1.76	0.07	0.45	-.06	.24	.14
Have children under 18	.053	.121	.101	.149	.031	.068	.059	.089	0.49	5.43☆	5.58☆	12.56☆	.05	.29	.23
Bachelor's from:															
Liberal arts coll. I	.057	-.023	-.001	-.037	.029	-.009	.000	-.016	0.41	0.12	0.00	0.52	-.02	-.02	-.04
Research university	.067	-.075	-.030	-.029	.039	-.046	-.018	-.017	0.71	2.86	0.60	0.55	-.06	-.11	-.08
Foreign institution	.095	.076	.075	.060	.026	.022	.021	.017	0.42	0.73	0.98	0.62	-.02	.03	.01
Constant	1.585	1.659	1.732	1.615											
Sex is female			-.199								27.60☆				-.16
R^2	.520	.624	.591	.580											
Adjusted R^2	.504	.617	.536	.575											
Number of cases	360	668	1023	1028											
Std. error of prediction	.592	.502	.535	.542											

☆F > 3.84, nominal 0.05 significance level

TABLE 6.6 Predictors of faculty rank at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of biosciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined
Years since doctorate	.047	.095	.076	.074	.303	.579	.469	.454	15.26[a]	115.99[a]	118.02[a]	107.88[a]	.61	.72	.68
Years FTE experience	.045	.021	.032	.034	.400	.164	.257	.270	26.74[a]	9.30[a]	35.91[a]	38.69[a]	.65	.66	.64
Employer:															
Four-year college	-.164	.032	-.004	-.042	-.088	.011	-.002	-.018	2.49	0.13	0.00	0.41	-.03	.01	-.04
Research univ. I, other than medical school	-.054	.065	.031	.044	-.022	.030	.014	.019	0.18	0.83	0.24	0.47	.06	.03	.05
Medical school	-.390	.101	-.155	-.152	-.198	-.063	-.095	-.093	12.61[a]	3.24	10.54[a]	9.38[a]	-.19	-.10	-.12
Roose-Andersen rating of Ph.D. dept.	.007	-.003	.003	.007	.011	-.004	.005	.010	0.05	0.02	0.03	0.14	.02	.03	.04
Married at doctorate	-.005	-.099	.044	.068	-.003	.048	.025	.038	0.00	2.21	0.69	1.60	-.09	.10	.08
Married as of 1979	.145	.065	.060	.112	.093	.026	.031	.057	2.35	0.65	1.00	3.47	-.06	.11	.10
Have children under 18	-.207	.106	.003	.559	-.127	.056	.002	.033	5.09[a]	2.31	0.00	1.15	-.12	.18	.14
Bachelor's from:															
Liberal arts coll. I	-.063	-.098	-.094	-.157	-.034	-.031	-.037	-.063	0.41	1.06	1.94	5.50[a]	-.10	-.08	-.12
Research university	.010	.049	.044	.046	.006	.030	.027	.028	0.02	0.90	0.97	1.06	-.03	.09	.07
Foreign institution	-.135	-.104	-.108	-.080	-.028	-.032	-.029	-.022	0.36	1.05	1.33	0.70	-.03	-.01	.00
Constant	1.772	1.510	1.708	1.543											
Sex = female			-.239				-.137				23.62[a]				-.17
R^2	.497	.555	.531	.517											
Adjusted R^2	.473	.546	.523	.510											
Number of cases	256	553	809	809											
Std. error of prediction	.568	.541	.553	.566											

[a] F > 3.84, nominal 0.05 significance level

TABLE 6.7 Predictors of faculty rank at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of psychology and social sciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	.085	.095	.092	.091	.596	.633	.617	.612	68.56[a]	181.08[a]	248.08[a]	243.52[a]	.72	.76	.74
Years FTE experience	.018	.017	.013	.018	.153	.135	.146	.152	4.63[a]	8.28[a]	13.89	15.07[a]	.66	.68	.67
Employer:															
Four-year college	-.069	-.025	-.043	-.045	-.035	-.012	-.021	-.022	0.74	0.22	0.92	1.01	-.09	.01	-.03
Research univ. I, other than medical school	-.059	.036	.011	.008	-.030	.018	.006	.004	0.53	0.44	0.06	0.03	-.05	.10	.04
Medical school	-.363	-.539	-.472	-.476	-.110	-.157	-.139	-.140	8.10[a]	38.00[a]	41.96[a]	42.58[a]	-.11	-.20	-.17
Roose-Andersen rating of Ph.D. dept.	-.015	-.029	-.026	-.024	-.026	-.049	-.043	-.041	0.44	3.47	3.39[a]	3.46	.00	.01	.01
Married at doctorate	-.017	.018	.001	.017	-.010	.008	.000	.009	0.05	0.08	0.00	0.13	-.05	.10	.06
Married as of 1979	.064	.076	.054	.068	.039	.034	.028	.035	0.70	1.36	1.22	1.94	-.02	.09	.07
Have children under 18	-.072	.222	.115	.132	-.043	.125	.069	.079	1.04	20.96[a]	3.25[a]	11.17[a]	-.10	.16	.09
Bachelor's from:															
Liberal arts coll. I	-.014	-.040	-.041	-.063	-.006	-.014	-.016	-.024	0.02	0.28	0.50	1.16	.01	-.02	-.02
Research university	.006	.020	.006	-.001	.004	.012	.004	-.001	0.01	0.19	0.03	0.00	.03	.05	.06
Foreign institution	-.111	.153	.023	.017	-.029	.038	.007	.004	0.53	2.24	0.11	0.04	-.08	-.01	-.04
Constant	2.001	1.834	1.965	1.898											
Sex = female			-.098				-.057				6.25[a]				-.10
R^2	.548	.629	.593	.591											
Adjusted R^2	.532	.622	.588	.535											
Number of cases	339	617	956	956											
Std. error of prediction	.568	.501	.529	.530											

[a] F > 3.84, nominal 0.05 significance level

TABLE 6.8 Predictors of faculty rank at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of humanities

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	.063	.070	.063	.067	.378	.447	.421	.419	47.92*	134.27*	182.51*	179.55*	.65	.70	.68
Years FTE experience	.041	.039	.040	.041	.366	.344	.354	.359	42.22*	78.20*	127.04*	130.40*	.64	.68	.67
Employer:															
Four year college	-.093	.066	.009	.009	-.054	.039	.005	.005	2.01	2.22	0.06	0.06	.00	-.01	-.01
Research univ. I, other than medical school	-.247	-.055	-.117	-.108	-.102	-.026	-.054	-.050	6.76*	1.00	5.94*	5.08*	-.15	-.04	-.07
Medical school	.667	-.321	.034	.034	.041	-.014	.002	.002	1.24	0.34	0.01	0.01	.01	-.04	-.02
Roose-Andersen rating of Ph.D. dept.	.057	-.020	.003	.003	.036	-.030	.004	.004	.83*	1.44	0.04	0.03	.07	-.04	-.01
Married at doctorate	.089	.119	.105	.119	.054	.062	.060	.068	1.38	3.92*	4.92*	6.40*	-.13	.12	.05
Married as of 1979	-.134	.017	-.035	-.025	-.081	.009	-.020	-.014	3.17	0.08	0.54	0.28	-.13	.13	.06
Have children under 18	-.038	.094	.057	.074	-.022	.056	.034	.045	0.27	4.08*	2.06	3.56	-.10	.06	.03
Bachelor's from:															
Liberal arts coll. I	.083	-.017	.000	-.013	.042	-.015	.000	-.008	0.90	0.34	0.00	0.12	-.03	.10	-.02
Research university	.089	-.053	-.018	-.022	.053	-.032	-.011	-.013	1.45	1.38	0.22	0.31	.03	-.04	-.01
Foreign institution	-.019	-.094	-.091	-.095	-.005	-.028	-.026	-.027	0.02	1.23	1.50	1.60	-.02	-.02	-.01
Constant	1.583	1.746	1.763	1.702											
Sex is female			-.102				-.059				7.32*				-.10
R^2	.508	.562	.536	.533											
Adjusted R^2	.492	.555	.531	.528											
Number of cases	335	767	1152	1152											
Std. error of prediction	.588	.542	.561	.563											

*F ≥ 3.84, nominal 0.05 significance level

The results are summarized in Tables 6.9 - 6.12 for the analysis of faculty salaries at major research universities and in Tables 6.13 - 6.16 for the analysis of salaries at four-year colleges and universities. The sample sizes are slightly smaller than in the corresponding prediction equations for rank, because some members of the triads declined to supply salary information.

As in the prediction of rank, the total of the two experience terms is always the most important part of the prediction. Also, the average year's increase in salary, approximately the sum of the two partial coefficients, is always less for women than for men. The term, have children under eighteen, often appears and is positive--in the neighborhood of a $1,000 to $2,000 increase in salary--although the effect is generally not statistically significant. The exception is for women humanists at major research universities where the negative effect of having children is striking--a $5,000 decrease in annual salary.

The predictor variables, primary activity is administration and primary activity is teaching, often enter the prediction equations for salary, whereas they did not appear in the prediction of rank. The usual explanation is that the term "administrator" includes assistant deans as well as deans, and thus cuts across all ranks. The indication is that administrators receive an additional stipend which ranges from $2,000 to $6,000 per year, depending on the field. Whenever teaching enters a prediction equation, its coefficient is negative, reflecting its reward in competition with research and administration. The teaching term never enters the stepwise prediction equation for the salary of women faculty in major research universities. When teaching is entered as one of the fixed predictors in the second set of analyses, its coefficient is never significantly different from zero for women, even though this term is often significant for men and for the combined group.

Employment in a medical school has a positive effect on salary, whereas its effect on rank is negative. This appears to be a reflection of the higher salary scale at medical schools. The prestige of the faculty member's Ph.D.-granting department, as measured by its Roose-Andersen rating, tends to be positively related to salary, but is not significant. Receiving an undergraduate degree from a foreign university has a negative effect in most cases, especially in the equation for women. However, none of these terms is large or important in the prediction. We find that being married usually has a negative effect on the salary of a woman, but a positive effect on the salary of a man. The term, sex is female, can occur only in the equation predicting salary for both sexes combined. Its contribution is always negative and large, especially in the research universities, where it ranges from -$1,200 in the humanities to -$4,000 in the biosciences.

TABLE 6.9 Predictors of faculty salaries at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of mathematics, physical sciences, and engineering

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term:		Women	Men	Combined, with sex term:		Women	Men	Combined, with sex term:		Women	Men	Combined
			in	out			in	out			in	out			
Years since doctorate	--	843	371	348	--	.670	.292	.273	--	145.49[a]	7.79[a]	6.77[a]	--	.70	.63
Years FTE experience	730	--	355	383	.616	--	.338	.365	46.77[a]	--	10.65[a]	12.39[a]	.58	--	.63
Primary activity is:															
Administration	-2592	2940	2002	2198	-.102	.135	.087	.095	1.10	6.22[a]	3.04	3.63	-.04	.18	.13
Teaching	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Employed in med. school+	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Roose-Andersen rating of Ph.D. dept.	895	--	408	453	.189	--	.078	.087	3.62	--	2.45	3.01	.10	--	.07
Married at doctorate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Married as of 1979	-3436	1625	--	--	-.257	.091	--	--	6.58[a]	2.65	--	--	-.09	.30	--
Have children under 18	2018	--	798	1055	.160	--	.059	.078	2.63	--	1.36	2.42	.07	--	.26
Bachelor's from:															
Liberal arts coll.	-2992	1790	--	--	-.198	.078	--	--	2.96	1.76	--	--	-.02	-.03	--
Research university	-3407	1966	657	768	-.274	.145	.049	.057	5.64[a]	5.26[a]	1.02	1.38	-.11	.03	-.001
Foreign institution	-3824	2222	--	--	-.150	.095	--	--	2.20	2.60	--	--	-.05	.09	--
Constant	17237	14994	15986	15023											
Sex is female	--	--	-1551	--	--	--	-.107	--	--	--	4.76[a]	--	--	--	-.21
R^2	.455	.529	.451	.441											
Adjusted R^2	.393	.512	.436	.427											
Number of cases	79	175	254	254											
Std. error of prediction	4872	4733	5074	5112											

[a] F > 3.84, nominal 0.05 significance level

+Entries in parentheses refer to: Employed in public university

TABLE 6.10 Predictors of faculty salaries at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of biosciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r		
	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined
Years since doctorate	949	641	814	798	.676	.350	.456	.447	16.24*	13.43*	121.55*	111.22*	.51	.50	.49
Years FTE experience	-256	195	--	--	-.223	.122	--	--	1.79	1.67	--	--	.39	.43	--
Primary activity is:															
Administration	4141	4906	4056	3984	.185	.163	.143	.140	3.68	12.06*	11.97*	10.96*	.21	.22	.21
Teaching	--	-1968	-1375	-1636	--	-.090	-.068	-.081	--	3.31	2.68	3.59	--	-.12	-.10
Employed in med. school+	--	3199	2461	(-2526)	--	.163	.126	(-.147)	--	11.50*	9.72*	(7.90)*	--	.17	.12
Roose-Andersen rating of Ph.D. dept.	612	490	5097	557	.116	.065	.072	.078	1.96	1.79	3.07	3.55	.14	.05	.09
Married at doctorate	-1561	1589	--	--	-.115	.076	--	--	1.86	2.05	--	--	-.14	.13	--
Married as of 1979	--	--	--	1616	--	--	--	.076	--	--	--	2.47	--	--	--
Have children under 18	--	1423	1495	2034	--	.071	.084	.114	--	1.69	3.69	5.22*	--	.21	.25
Bachelor's from:															
Liberal arts coll. I	--	--	--	-1663	--	--	--	-.057	--	--	--	1.88	--	--	--
Research university	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Foreign institution	-5345	--	-1630	-1406	-.130	--	-.049	-.042	1.83	--	1.48	1.04	.06	--	[illegible]
Constant	16591	14405	16515	16391											
- - - - - - - - - - - -															
Sex is female	--	--	-4019	--	--	--	-.203	--	--	--	22.20*	--	--	--	-.24
R^2	.324	.331	.349	.320											
Adjusted R^2	.283	.313	.337	.306											
Number of cases	107	315	422	422											
Std. error of prediction	5800	7300	7000	7200											

*F > 3.84, nominal 0.05 significance level

+Entries in parentheses refer to: Employed in public university

TABLE 6.11 Predictors of faculty salaries at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of psychology and social sciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined
Years since doctorate	--	705	532	536	--	.424	.344	.347	--	13.07*	14.52*	14.06*	--	.69	.65
Years FTE experience	707	376	426	435	.713	.262	.326	.333	88.28*	4.91*	12.68*	12.60*	.68	.67	.66
Primary activity is:															
Administration	--	2448	1915	1841	--	.102	.085	.082	--	2.32	2.62	2.30	--	.31	.29
Teaching	--	-2000	-1653	-1616	--	-.105	-.094	-.091	--	2.57	3.16	2.96	--	-.23	-.21
Employed in med. school+	(-1774)	(-1696)	(-1774)	(-1509)	(-.130)	(-.088)	(-.100)	(-.085)	(2.87)	(2.30)	(4.29)*	(2.98)	(-.05)	(-.06)	(-.04)
Roose-Andersen rating of Ph.D. dept.	-478	427	--	--	-.086	.057	--	--	1.26	0.97	--	--	-.02	.07	--
Married at doctorate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Married as of 1979	-1641	--	-1946	-1264	-.119	--	-.099	-.064	2.48	--	4.29*	1.80	-.07	--	.05
Have children under 18	--	--	1573	2343	--	.073	.087	.129	--	--	3.22	7.24*	--	--	.13
Bachelor's from:															
Liberal arts coll.	--	2187	--	--	--	.057	--	--	--	1.00	--	--	--	.01	--
Research university	1760	--	--	--	.128	--	--	--	2.81	--	--	--	.09	--	--
Foreign institution	--	--	-2094	-2299	--	--	-.057	-.062	--	--	1.56	1.79	--	--	-.15
Ph.D. is psychology	--	--	-1103	-1102	--	--	-.062	-.062	--	--	1.53	1.44	--	--	.00
Constant	20465	16613	21675	19224											
Sex is female	--	--	-3126	--	--	--	-.171	--	--	--	12.79*	--	--	--	-.22
R^2	.515	.546	.540	.515											
Adjusted R^2	.487	.520	.520	.496											
Number of cases	92	152	244	244											
Std. error of prediction	4900	6600	6100	6300											

*F > 3.84, nominal 0.05 significance level

+Entries in parentheses refer to: Employed in public university

TABLE 6.12 Predictors of faculty salaries at research universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of humanities

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined, with sex term: in	out	Women	Men	Combined
Years since doctorate	792	390	544	530	.597	.279	.390	.380	40.28*	9.21*	23.23*	22.01*	.71	.66	.63
Years FTE experience	--	403	235	259	--	.378	.222	.244	--	16.84*	7.37*	9.10*	--	.65	.64
Primary activity is:															
Administration	4479	5891	6125	6004	.218	.271	.280	.274	4.94*	18.41*	24.82*	23.75*	.51	.48	.48
Teaching	--	-3062	-2171	-2236	--	-.201	-.140	-.145	--	10.36*	6.41*	6.76*	--	-.38	-.39
Employed in med. school+	(2713)	--	--	--	(.205)	--	--	--	(4.75)*	--	--	--	(.21)	--	--
Roose-Andersen rating of Ph.D. dept.	-1411	596	--	--	-.257	.092	--	--	5.73*	3.04	--	--	-.18	.01	--
Married at doctorate	1689	1113	--	--	.129	.067	--	--	1.45	1.20	--	--	-.15	.16	--
Married as of 1979	4089	1393	2111	2234	.315	.083	.135	.143	11.06*	1.88	7.40*	8.32*	.31	.21	.26
Have children under 18	-5136	--	-850	-703	-.395	--	-.061	-.050	15.23*	--	1.48	1.02	-.20	--	.08
Bachelor's from:															
Liberal arts coll. I	1511	--	--	--	.109	--	--	--	1.75	--	--	--	.01	--	--
Research university	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Foreign institution	-4867	-1988	-2042	-2131	-.188	-.067	-.070	-.073	4.83*	1.62	2.28	2.47	-.02	-.06	-.05
Constant	16738	12792	16001	15441											
Sex is female	--	--	-1185	--	--	--	-.074	--	--	--	2.42	--	--	--	-.19
R^2	.790	.667	.642	.637											
Adjusted R^2	.737	.646	.625	.622											
Number of cases	46	138	184	184											
Std. error of prediction	3300	4200	4300	4300											

*$F \geq 3.84$, nominal 0.05 significance level

+Entries in parentheses refer to: Employed in public university

TABLE 6.13 Predictors of faculty salaries at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of mathematics, physical sciences, and engineering

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	356	607	488	477	.308	.481	.394	.385	12.47*	63.89*	66.66*	63.60*	.57	.66	.63
Years FTE experience	286	163	237	242	.313	.155	.234	.239	12.34*	6.88*	23.97*	24.82*	.53	.61	.58
Primary activity:															
Administration	566	3392	2836	3000	.022	.156	.123	.131	0.20	23.10*	21.34*	23.91*	.10	.29	.25
Teaching	-1113	-1311	-1262	-1196	-.087	-.094	-.092	-.087	2.73	7.88*	10.32*	9.68*	-.12	-.25	-.20
Employer:															
Four-year college	-3137	-1732	-2266	-2302	-.245	-.120	-.162	-.164	22.73*	14.52*	36.88*	37.81*	-.22	-.26	-.25
Research univ. I, other than medical school	-216	814	511	583	-.014	.055	.034	.039	0.08	3.15	1.71	2.22	≈.00	.11	.09
Medical school	-67	1670	899	759	-.003	.042	.027	.023	<0.01	2.06	1.15	0.82	.02	.06	.03
Public institution	1219	1492	1454	1476	.097	.106	.107	.108	3.81	13.53*	18.47*	18.89*	.11	.14	.13
Roose-Andersen rating of Ph.D. dept.	262	182	192	211	.063	.040	.043	.047	1.77	1.75	2.93	3.49	.05	.05	.05
Married at doctorate	591	910	664	682	.049	.063	.049	.051	0.75	3.86*	3.10	3.25	.01	.10	.09
Married as of 1979	-1024	647	-122	10	-.083	.035	-.008	.001	2.17	1.12	0.07	0.00	.01	.20	.15
Have children under 18	944	478	702	948	.077	.033	.054	.073	2.22	1.01	3.49	6.66*	.13	.20	.21
Bachelor's from:															
Liberal arts coll. I	-640	-55	-317	-487	-.045	-.003	-.018	-.028	0.70	0.01	0.47	1.13	-.04	-.00	-.07
Research university	113	813	564	570	.099	.062	.044	.044	0.03	4.06*	2.68	2.72	-.01	.03	.02
Foreign institution	-354	1137	619	534	-.014	.041	.023	.019	0.09	1.98	0.86	0.64	≈.00	.05	.03
Constant	16649	14257	15671	15017											
- - - - - - - - - - - - -															
Sex is female			-960				-.071				8.14*				
R^2	.430	.562	.519	.515											
Adjusted R^2	.402	.552	.511	.507											
Number of cases	320	614	934	934											
Std. error of prediction	4638	4355	4470	4488											

*F > 3.84, nominal 0.05 significance level

TABLE 6.14 Predictors of faculty salaries at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of biosciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	590	597	610	587	.484	.353	.380	.366	28.96*	28.66*	56.18*	50.86*	.58	.48	.49
Years FTE experience	46	145	106	121	.051	.108	.086	.097	0.33	2.63	2.86	3.61	.44	.38	.39
Primary activity:															
Administration	2577	4567	3882	3804	.113	.168	.144	.141	3.64	20.12*	22.09*	20.66*	.22	.26	.25
Teaching	-713	-1512	-1214	-1475	-.057	-.090	-.076	-.093	0.76	4.28*	4.61*	6.69*	-.19	-.25	-.27
Employer:															
Four-year college	-2220	-1976	-1639	-1913	-.152	-.070	-.071	-.083	5.61*	3.18	4.60*	6.14*	-.29	-.20	-.25
Research univ. I, other than medical school	481	1436	1089	1215	.024	.065	.049	.054	0.17	2.51	2.19	2.66	.05	-.03	.01
Medical school	2406	4699	3979	4051	.189	.283	.248	.252	4.77*	21.11*	25.72*	25.96*	.18	.29	.27
Public institution	1782	106	606	715	.144	.006	.038	.045	3.76	0.01	0.80	1.09	.02	-.21	-.15
Roose-Andersen rating of Ph.D. dept.	328	143	241	279	.063	.021	.037	.043	1.31	0.33	1.55	2.02	.04	.06	.06
Married at doctorate	-998	1557	487	717	-.081	.074	.028	.041	1.38	3.59	0.63	1.34	-.04	.08	.11
Married as of 1979	764	500	320	933	.062	.019	.017	.049	0.82	0.25	0.22	1.89	-.02	.09	.14
Have children under 18	140	1029	756	1360	.011	.054	.046	.083	0.03	1.70	1.58	5.23*	.05	.13	.20
Bachelor's from:															
Liberal arts coll. I	-342	161	-321	-1026	-.023	.005	-.013	-.041	0.15	0.02	0.17	1.78	-.07	-.06	-.11
Research university	-64	293	149	186	-.005	.018	.009	.012	0.01	0.21	0.09	0.13	.00	.04	.06
Foreign institution	-2104	-445	-387	-634	-.059	-.013	-.025	-.018	1.13	0.12	0.71	0.36	-.02	.03	.04
Constant	15071	14306	16205	14437											
Sex is female			-2643				-.153				21.01*				-.25
R^2	.433	.334	.410	.393											
Adjusted R^2	.393	.366	.397	.381											
Number of cases	229	529	758	758											
Std. error of prediction	4799	6556	6143	6225											

*F > 3.84, nominal 0.05 significance level

TABLE 6.15 Predictors of faculty salaries at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of psychology and social sciences

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	362	774	631	624	.308	.534	.463	.458	15.52*	103.54*	15.20*	111.04*	.64	.67	.65
Years FTE experience	335	126	205	213	.349	.105	182	.190	19.44*	3.99*	17.--	18.82*	.64	.58	.59
Primary activity:															
Administration	2033	3473	2850	2877	.106	.160	.136	.137	4.14*	19.23*	20.77*	20.85*	.21	.35	.31
Teaching	-186	-916	-874	-810	-.013	-.055	-.054	-.050	0.06	2.11	3.24	2.74	-.09	-.32	-.24
Employer:															
Four-year college	-2323	-1594	-1796	-1816	-.143	-.082	-.097	-.098	10.29*	7.60*	15.60*	15.72*	-.27	-.16	-.19
Research univ. I, other than medical school	962	2098	1844	1789	.060	.107	.100	.097	1.72	12.53*	15.65*	14.52*	.08	.13	.14
Medical school	1943	6991	5103	5135	.069	.207	.159	.160	2.16	43.57*	37.17*	37.08*	.07	.16	.13
Public institution	1121	1389	1287	1360	.078	.081	.079	.083	3.08	7.05*	9.94*	10.94*	.07	-.00	.02
Roose-Andersen rating of Ph.D. dept.	240	-101	-9	19	.049	-.018	-.002	.003	1.26	0.38	0.01	0.02	.10	.09	.10
Married at doctorate	604	1200	857	1119	.044	.056	.049	.064	0.82	2.84	2.96	5.04*	-.02	.10	.08
Married as of 1979	-1459	-90	-791	-566	-.106	-.004	-.045	-.032	4.66*	0.02	2.56	1.31	-.09	.04	.03
Have children under 18	859	781	908	1146	.062	.046	.059	.075	1.96	2.32	5.11*	8.22*	-.01	.12	.10
Bachelor's from:															
Liberal arts coll. I	1310	1822	1238	836	.073	.062	.051	.035	2.30	4.44*	4.14*	1.92	.05	.03	.02
Research university	550	72	61	-58	.040	.005	.004	-.004	0.64	0.02	0.02	0.02	.14	.08	.09
Foreign institution	-183	401	-52	-283	-.006	.010	-.001	-.008	0.02	0.12	<0.01	0.10	-.09	-.01	-.04
Constant	15648	14996	16311	15175											
Sex is female			-1520				-.095				14.61*				-.12
R^2	.519	.567	.541	.534											
Adjusted R^2	.494	.556	.533	.526											
Number of cases	309	587	896	896											
Std. error of prediction	4835	5151	5175	5214											

*F > 3.34, nominal 0.05 significance level

TABLE 6.16 Predictors of faculty salaries at four-year colleges or universities based on matched triads of men and women who earned Ph.D.s during the period 1958-1978 in the field of humanities

	REGRESSION COEFFICIENT, ORDINARY				REGRESSION COEFFICIENT, STANDARDIZED				F-RATIO				ZERO-ORDER CORRELATION (SIMPLE r)		
	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined, with sex term: in	Combined, with sex term: out	Women	Men	Combined
Years since doctorate	482	516	510	506	.387	.396	.396	.392	37.50[a]	87.52[a]	129.40[a]	127.18[a]	.58	.61	.60
Years FTE experience	180	229	209	213	.214	.247	.232	.237	10.79[a]	33.47[a]	43.49[a]	45.49[a]	.49	.57	.55
Primary activity:															
Administration	3749	1731	2192	2187	.173	.078	.099	.099	9.60[a]	4.56[a]	10.67[a]	10.59[a]	.27	.27	.27
Teaching	-803	-3091	-2432	-2419	-.050	-.194	-.146	-.146	0.82	25.22[a]	23.24[a]	22.93[a]	-.25	-.30	-.28
Employer:															
Four-year college	-1962	-896	-1255	-1250	-.151	-.063	-.091	-.091	12.22[a]	4.58[a]	14.14[a]	14.00[a]	-.15	-.17	-.16
Research univ. I, other than medical school	-1155	302	-118	-48	-.064	.018	-.007	-.003	2.10	0.37	0.08	0.01	-.08	.08	.04
Medical school	12322	---	11346	10966	.108	---	.053	.052	6.66[a]	---	5.60[a]	5.23[a]	.11	--	.05
Public institution	2646	1234	1648	1613	.192	.087	.117	.114	21.06[a]	9.73[a]	25.83[a]	24.73[a]	.24	.15	.17
Roose-Andersen rating of Ph.D. dept.	394	251	301	300	.079	.047	.057	.057	3.27	2.83	5.99[a]	5.94[a]	.08	.07	.07
Married at doctorate	1367	630	976	1068	.110	.039	.070	.076	4.73[a]	1.27	5.46[a]	6.59[a]	-.02	.10	.09
Married as of 1979	-305	645	262	349	-.025	.039	.018	.024	0.23	1.28	0.38	0.69	.02	.11	.10
Have children under 18	-415	179	-15	91	-.032	.013	-.001	.007	0.46	0.17	0.00	0.07	-.03	.06	.05
Bachelor's from:															
Liberal arts coll. I	657	-651	-173	-300	.045	-.032	-.010	-.017	0.79	1.25	0.15	0.45	-.03	-.03	-.04
Research university	409	168	191	161	.032	.012	.014	.012	0.42	0.17	0.32	0.22	.02	.04	.03
Foreign institution	1090	-385	55	19	.037	-.014	.002	.001	0.76	0.24	0.01	≈0.00	.03	-.02	-.01
Constant	12543	15250	14830	14447											
Sex is female			-680				-.048				3.99[a]				-.08
R^2	.478	.499	.486	.484											
Adjusted R^2	.453	.499	.478	.476											
Number of cases	336	724	1060	1060											
Std. error of prediction	4589	4764	4725	4732											

[a] F > 3.84, nominal 0.05 significance level

The prediction equations for rank and those for salary have very similar patterns, especially for the more important predictor variables. In particular, a comparison of the prediction equations for women with those for men shows similarities indicating that a large part of the lower salaries for women is closely associated with the lower ranks for women. We thus conclude that rank cannot be used as a predictor for salary, since rank is itself influenced by gender. This can be (and was) verified by computing the predicted salary equations with rank included as a predictor. As anticipated, rank tightens the prediction but also distorts it. Due to the collinearity between rank and other predictors, all of the coefficients in the prediction equations are affected. Since some of the differences between men's and women's salaries are absorbed by the term in rank, the resulting residual in the salary of women is less.

Results of "opposite-sex equations"

The primary reason for constructing the prediction for rank and for salary is to indicate what the women in a triad sample would be paid if they were men of similar ability and occupation. We now compare, case by case, the actual salary of each woman in the sample with the estimated salary that she would receive if she were a man with the same characteristics. The difference between the actual salary and the estimated salary is the residual. A negative residual indicates an apparent deficit in her salary. A positive residual indicates an apparent excess. We expect that some women will have a deficit, while others will have an excess. The distribution of these residuals is of interest. Will the indications of deficit and excess tend to cancel out, so that the average residual is zero or close to zero, as is the case with men?

The results of the use of opposite-sex equations for our sample show residuals significantly different from zero, as summarized in Table 6.17. The mean residuals are more negative for the women faculty in major research universities than in universities and colleges as a whole. The largest deficits appear to be in the biosciences in both sets of analyses. For the 107 women bioscientists in major research universities whom we studied, the total deficit amounts to nearly $400,000, for an average differential of -$3,600 annually. These differences persist year after year, and tend to become larger as the number of years in academe increases.

The indicated deficits are largest for those women ten or more years past the doctorate, that is, the pre-1970 Ph.D.s. As shown in Figure 6.1 for women faculty in psychology and social sciences in major research universities, the negative residuals become more pronounced and more frequent with increasing years since the doctorate (moving from left to right on the plot). The pattern is similar when

TABLE 6.17 Summary of deficits in women faculty salaries. Mean difference of actual salary minus predicted salary using prediction equation for a man of same characteristics.

Type of institution	Field of Ph.D. (1958-1978 Ph.D.s)	No. of women in sample	Sum of residual	Mean residual
Major research universities	Mathematics, physical sciences, engineering	79	- $132,562	- $1,678
	Biosciences	107	- $387,233	- $3,619
	Psychology and social sciences	92	- $260,167	- $2,828
	Humanities	46	- $ 28,764	- $ 625
All 4-year colleges and universities	Mathematics, physical sciences, engineering	320	- $261,760	- $ 818
	Biosciences	228	- $441,864	- $1,938
	Psychology and social sciences	309	- $423,948	- $1,372
	Humanities	335	- $170,012	- $ 508

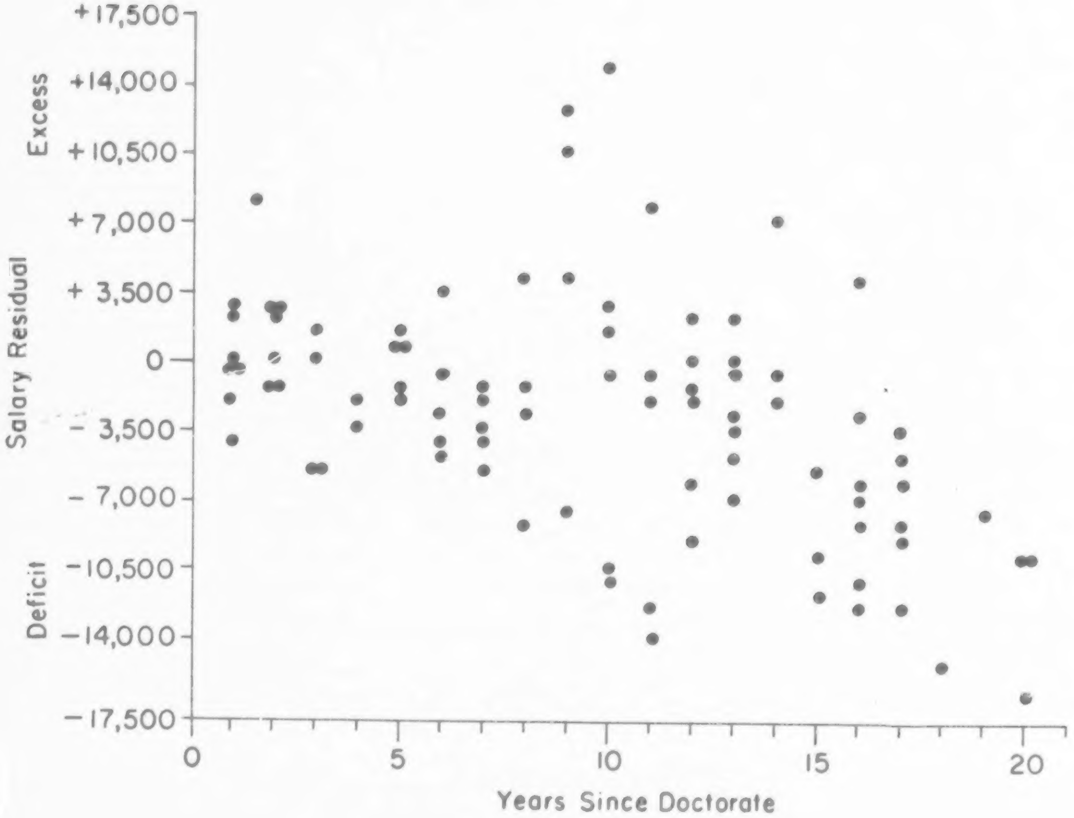

FIGURE 6.1 Distribution of salary residuals of faculty women who obtained Ph.D. 1958-1978 and are in triad sample employed full-time at major research university in psychology or social sciences, by years since doctorate. Actual 1979 salary of faculty woman minus predicted salary for man with same characteristics.

all four-year colleges and universities are considered. Figure 6.2 gives a plot of the residuals in salary (actual salary a woman receives minus what is predicted if she were paid like a man) for each of the four fields and for successive five-year periods since the award of the doctorate. The shape of the distribution is roughly the same for every field, ignoring the irregularities due to small sample size. The residuals are fairly well centered on zero for the newest group of Ph.D. women faculty; they shift toward the negative for the group of women who obtained the Ph.D. between six and ten years ago, and shift even more for the older women. The indications from the regression analyses and from the cohort comparisons, as well as from other studies, are that the distribution of the residuals will be even more negative for those women who obtained the doctorate more than 20 years ago, as it continues to shift towards deficit with each successive cohort.

How should these results be interpreted? We note systematic patterns of deficit in rank and in salary of women faculty both in the major research universities and in the selection from all four-year colleges and universities. The deficits tend to be double in the research universities, and also to be more striking for the older cohorts even though we are omitting anyone not employed full-time in 1979 or with appreciable breaks in employment. One interpretation is discrimination against women as a class or as individuals.

But discrimination is not proven by the results of the studies, especially because there are omissions in the possible predictor variables, in particular, measures of productivity. But, as noted earlier, women tend to publish as much and more than men in the same field in the same kind of institution, so productivity records are very unlikely to change the comparison.

Within-pair salary differences

The triad of matched doctorates offers the possibility of studying the details in salary differences between men and women. However, when we restrict attention to those members of the triads who had full-time employment in major research universities and who supplied all the needed demographic and salary information, and then identify those triads which have the woman and at least one man satisfying all the requirements, we find that the sample size has decreased very rapidly--only 66 within-pair comparisons remain! In order to obtain a large enough sample to perform a reliable analysis, some of the restrictions on the matching must be removed. For example, relaxing the employment location to all four-year colleges and universities will change the sample size by an order of magnitude or more. Time did not permit a complete study.

The results from the small sample of 66 matched pairs suggests conclusions that are similar to what was found from the opposite-sex

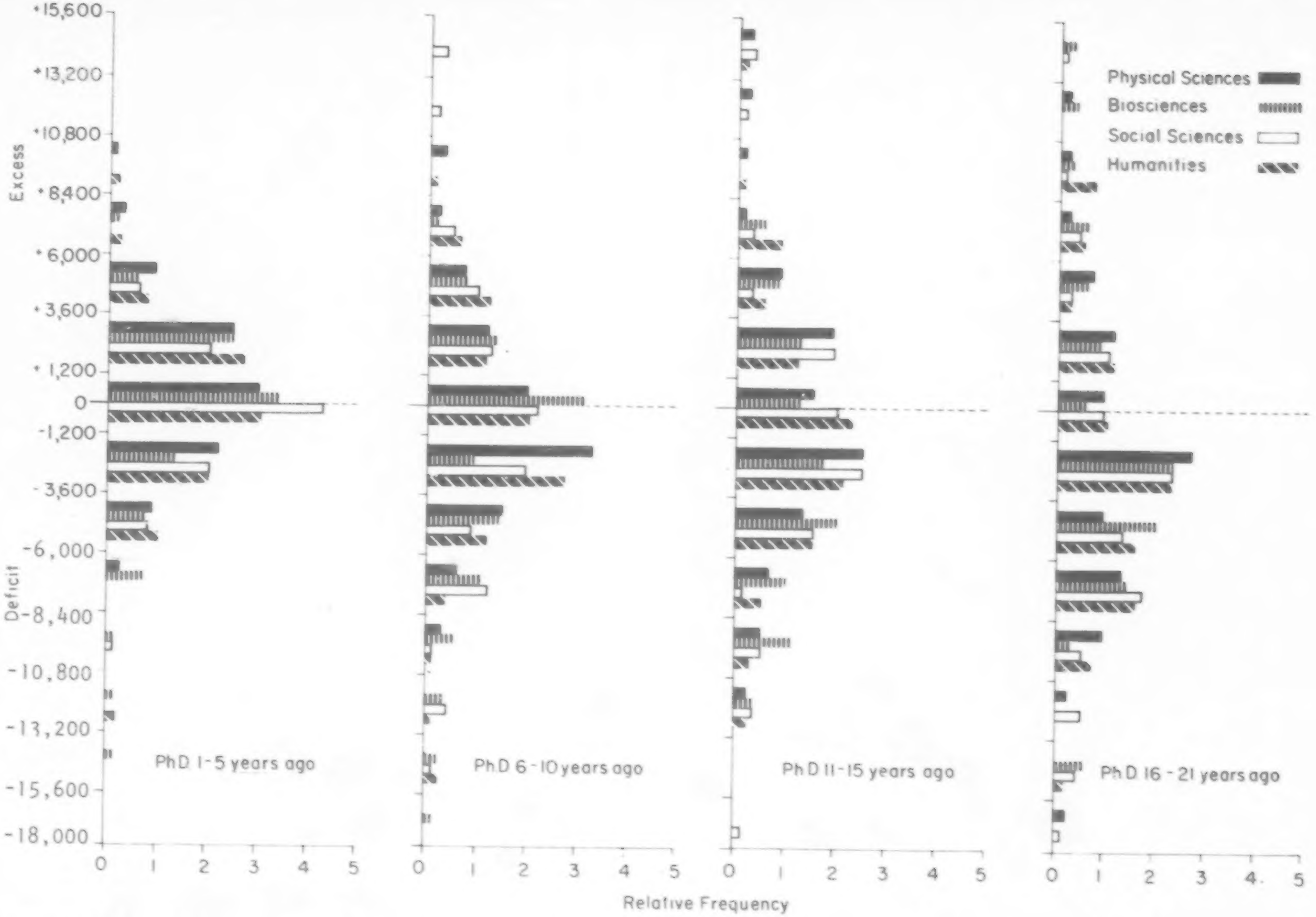

FIGURE 6.2 Distribution of salary residuals of faculty women who obtained Ph.D. 1958-1978 and are in triad sample employed full-time in 4-year college or university, by field and cohort of doctorate. (Residual is actual 1979 salary minus predicted salary for man with same characteristics.)

equations study and also what was noted in the direct comparisons in earlier chapters. As a preliminary indication, to be verified in larger samples, it appears that the prediction equation for the differences in salary within the pair, salary of the man minus salary of the woman, should include (i) the number of years since the woman received the doctorate, (ii) the difference in the years FTE experience of the man minus that of the woman, and (iii) a linear combination of possible but not so important index variables corresponding to: have children under 18, married at time of doctorate, baccalaureate from liberal arts college I, and primary activity is administration. In each case, the corresponding index should be defined as the number of times the man answered "yes" plus the number of times the woman answered "yes." For example, if in a matched pair neither the man nor the woman has children under 18 then the index for this pair has value 0 as its first component. If one or the other but not both has children under 18 the index has value 1, and if both have children the value of the index component for this pair is 2. This definition reflects the tendency for these variables to have a negative effect on the salary of women yet a positive effect for men.

It would be interesting to fit such a regression equation to the salary differences in matched pairs corresponding to cohorts who received the doctorate during the same time period, as was done for the direct comparisons. The various employment requirements could be successively relaxed so that a pattern of the differences would emerge going from matched employment to no restriction on employment.

CHAPTER 7

CONCLUSIONS

Numerous studies of male and female faculty have found wide sex differences in academic rank and pay. It is often suggested that these differences are due to: a) the greater proportions of women among recent Ph.D.s, with more of them accordingly holding junior positions; b) the different field distributions of men and women Ph.D.s; c) the presumed constraints on career mobility faced by married women; and d) the greater likelihood that women have interrupted their careers for child-bearing and child-rearing, thereby losing years of experience.

We found that such explanations do not agree with our findings. Differences in rank and salary remain after matching. Women Ph.D.s are not likely to drop out of the labor force even if they have children. Only 10 percent of the women with young children do so. Moreover, relatively few women doctorates--less than half--have children. Unmarried women or those without children do not fare any better in faculty promotions than married women with children.

Similarly, there are no indications that sex differences are due to reduced mobility of women doctorates. Among the sample of junior faculty who were surveyed in 1975 and again in 1979, the women were somewhat more likely than the men to have moved to a new institution, although this need not entail a geographic move.

Overall, the men and women in the matched sample were equally likely to be found in highly rated departments, with a greater proportion of men so employed among pre-1970 Ph.D.s, but a greater percentage of women employed in top departments since 1975.

Among the academically employed, the largest differences appear in advancement in rank. At each level, women are more likely than their matched male counterpart to be in a nonfaculty or junior faculty position. Comparative salaries reflect this difference.

The equations for estimating faculty salaries, using major research universities, were found to vary by field. However, when the data describing the women faculty in the sample were entered in the equations for predicting male salaries in the same field, the actual salaries for women tended to be less than the expected salary that a man of similar capabilities and experience would receive.

The years since 1970 do not reveal any striking changes in the sex differences for matched pairs in academe. As shown in Figure 7.1, the discrepancies in the type of position persist for the more recent cohorts: fewer women than men obtain faculty positions even among those who are in academe, and for those who do, the advancement in rank continues to lag for women. The median 1979 salary (see Table 7.1) of the women in matched pairs continues to be lower than that of men although the percentage difference is somewhat less for the younger cohorts. Since the sex differences increase in each cohort as the years go by, we could ascribe the somewhat smaller percentage salary differential in the recent cohorts just to the corresponding younger ages of its members. The salary deficit for women in the 1975-1978 cohort is 5 percent overall, as it is for the 1970-1974 cohort.

We emphasize that these findings refer to possible indications of sex discrimination in career outcomes of women in our sample of matched triads of Ph.D.s who hold academic positions. The problems of the career utilization of the much larger group of women in science, engineering, and humanities who do not have the Ph.D. or were unable to find and retain suitable academic appointments or industrial positions in 1979 are not addressed in this report, due to constraints on time and funds.

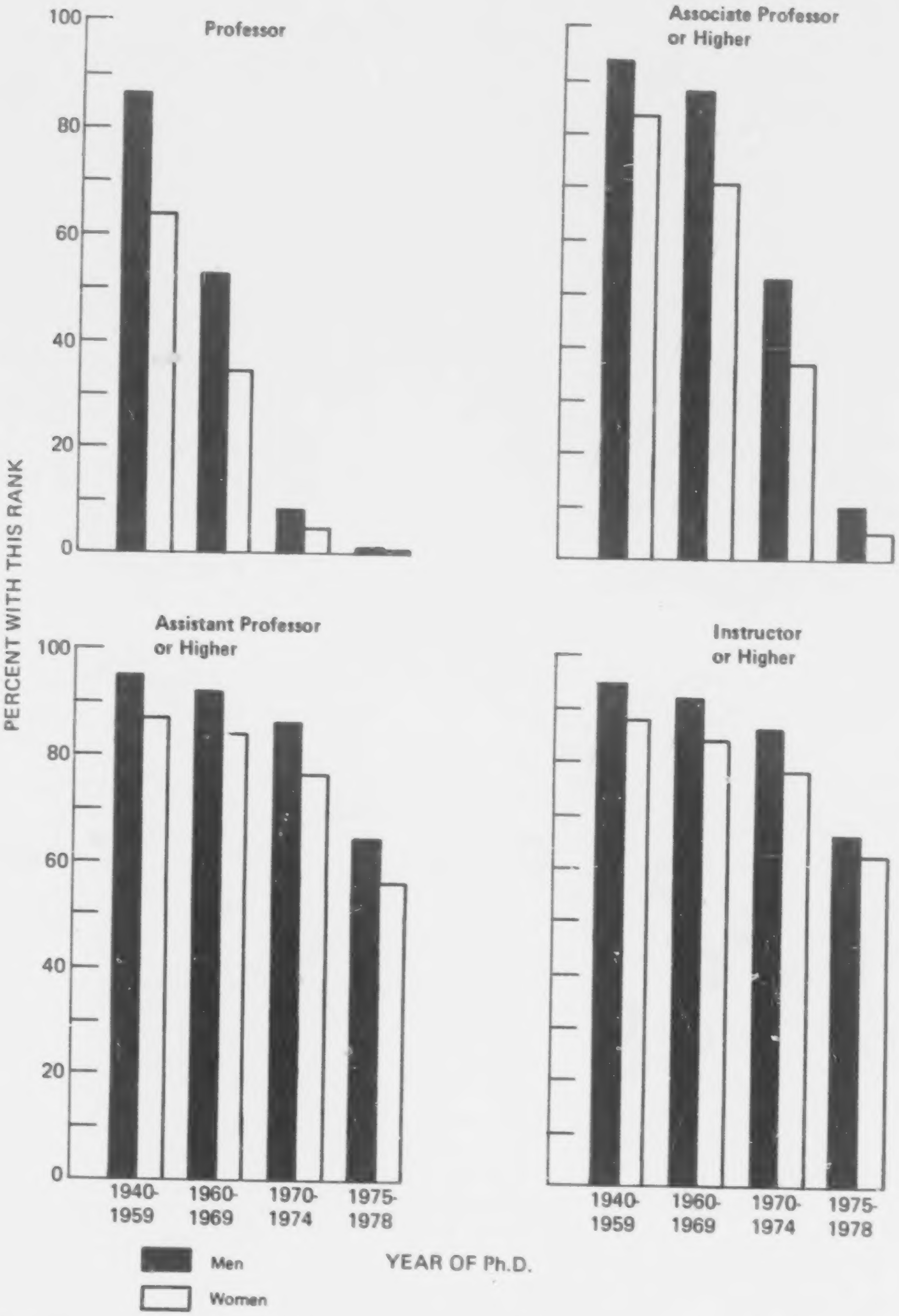

FIGURE 7.1 Type of position held in 1979 by matched pairs of men and women in academe, by cohort

TABLE 7.1 Median annual 1979 salaries of matched pairs of men and women in academe, by field and year of Ph.D. (Number of pairs shown in parentheses)

		thousands of $			
		1940-1959	1960-1969	1970-1974	1975-1978
All fields	Men	34.1	28.4	22.5	19.4
	Women	30.3	25.5	21.3	18.5
	% Less	11%	10%	5%	5%
		(308)	(717)	(529)	(375)
Math	Men	34.0	28.2	22.6	19.3
	Women	33.7	25.1	21.1	18.9
	% Less	<1%	11%	7%	2%
		(30)	(83)	(45)	(46)
Physics	Men	36.0	27.4	22.6	22.7
	Women	31.7	25.3	22.2	21.5
	% Less	12%	8%	2%	5%
		(18)	(37)	(29)	(12)
Chemistry	Men	29.8	27.3	21.8	21.5
	Women	25.6	23.6	20.8	18.2
	% Less	14%	14%	5%	15%
		(19)	(48)	(25)	(13)
Biological sciences	Men	34.0	28.5	23.2	20.5
	Women	29.4	24.0	21.0	18.4
	% Less	14%	16%	9%	10%
		(74)	(144)	(123)	(44)
Psychology	Men	37.0	29.5	22.9	19.1
	Women	34.2	26.0	22.6	18.5
	% Less	8%	12%	1%	3%
		(36)	(68)	(35)	(25)
Social sciences	Men	36.0	31.1	22.2	20.1
	Women	31.3	28.4	22.6	19.2
	% Less	13%	9%	- 2%	4%
		(46)	(106)	(64)	(57)
Languages & literature	Men	30.3	25.8	20.9	17.4
	Women	27.2	25.3	19.4	16.6
	% Less	10%	2%	7%	5%
		(34)	(93)	(79)	(64)
Other humanities	Men	30.0	26.9	21.9	18.8
	Women	29.5	24.2	20.4	17.4
	% Less	2%	10%	7%	7%
		(37)	(108)	(89)	(74)

NOTE: Percentages given are the percent by which female median salary is less than male median salary.

CHAPTER 8

VALIDITY AND RELIABILITY OF RESULTS

The validity of the results presented in this study is sensitive to several sources of possible bias in the selection of individuals to be compared as well as to sampling variability. The first difficulty is that only about 66 percent of the total number of Ph.D.s over the period studied responded to the survey questionnaire out of those who were sampled. A study by Harmon[1] of the response rate by sex and cohort for the 197 and 1977 surveys shows (see Table .1) that women who obtained the Ph.D. in 1940-1949 have an active response rate that is about 10 percent lower than the rate for men. However, for the doctorates after 1950, the active response rate jumps up to over 80 percent with women only 2 percent lower than men. The difference in the percentage who never responded is about one percent. The difference in the percentage deceased is less than one percent, with women being higher in each instance. The largest differences occur in the percentage retired which is 11 percent greater for women in the 1940-1944 cohort, 6 percent greater in the 1945-1949 cohort, but only one percent more for those who obtained the Ph.D. from 1950 to 1972. Nevertheless, there is evidence suggesting that those who do not respond are more likely to be unemployed and not seeking employment, or employed at a lower salary, and thus inhibited from replying.[2] In fact, part of the nonresponse is due to failure to locate the individual which would not occur if one were active in the profession. The indication thus is that lack of response to the questionnaire introduces a bias towards underestimating the salary decrement for women, but this bias will be small for the cohorts beyond 1950.

Another possible source of bias is the strict matching of persons selected for inclusion in the matched triad or the matched pair. It may be that only certain categories of individuals can be matched.

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[1] *Career Patterns of Doctoral Scientists and Engineers, 1973-1977*, National Research Council, 1979.

[2] See *Item Response Analysis: 1979 Survey of Doctorate Recipients*, National Research Council, 1980, pp. 10 and 15.

This possibility could be investigated by relaxing the matching and repeating the comparisons with the larger samples. Time and money do not permit further computations now. However, a comparison of the frequency of several characteristics in the matched group with a corresponding frequency in a completely unmatched group shows a remarkable agreement (see Table 8.2). We can hope that the lack of bias extends to career outcomes also.

The study was designed with matched triads so as to have the possibility of investigating the sampling variability built into the survey. For each woman in the triad, there are two matched men so that two comparisons can be made. The difference between the comparison with the first male and the comparison with the second male provides a direct measure of the sampling variability. Thus, the inner precision or reliability of the results can be estimated directly. The comparisons have not been completed for two reasons: first, the number of matched triads is not large because of the many restrictions imposed to force a tight match; secondly the number of matched pairs is much larger (using the better match if two are possible). In order to have larger sample sizes, much of this study is performed with matched pairs. The computations could be repeated with the woman in the triad compared to each male separately. A sample comparison is given in Figure 8.1 which shows median 1979 annual salaries of members of the matched triads in academe, by field and cohort. The conclusions are very consistent for the two comparisons as well as for field and cohort. Women systematically receive lower salaries than the corresponding matched men (the only exception being the latest group in physics, where the number of women doctorates is small).

TABLE 8.1 Doctoral scientists and engineers by Ph.D. cohort, sex, and response category, 1973-1977

Ph.D. cohort	Sex	Total (N)	Deceased (%)	Never resp. (%)	Retired (%)	Active resp. (%)
1940-44	Men	8,745*	14.2	13.5	17.7	54.5
	Women	779	13.5	11.8	29.1	45.6
	Both	9,524	14.1	13.4	18.7	53.8
1945-49	Men	9,176	9.7	15.2	8.3	66.8
	Women	953	11.9	17.4	13.9	56.9
	Both	10,129	9.9	15.4	8.8	65.9
1950-72	Men	195,877	1.8	14.8	0.7	82.7
	Women	18,622	2.3	15.6	1.6	80.5
	Both	214,499	1.9	14.8	0.8	82.5

*Numbers shown in the table are weighted n's.

SOURCE: Lindsey R. Harmon, Career Patterns of Doctoral Scientists and Engineers, 1973-1977, National Research Council, 1979, p. 4.

TABLE 8.2 Comparison of characteristics of women in "A" matched sample with estimated characteristics of women in population of doctoral scientists, engineers, and humanists

	Matched group	Unmatched group* (Weighted pop'n.)
1940-1959 female Ph.D.s		
% married+	44.2	46.3
% in labor force	74.3	68.8
1960-1969 female Ph.D.s		
% married+	53.6	58.0
% in labor force	94.2	92.3
1970-1974 female Ph.D.s		
% married+	61.9	60.3
% in labor force	93.9	93.3
1975-1978 female Ph.D.s		
% married+	54.2	58.9
% in labor force	95.3	94.6
1940-1978 female Ph.D.s, total		
% of academics in research univ. I	23.0	26.0

*The percent married is based on women in Math, Physics, Chemistry, Biosciences, Psychology, Social Sciences, Languages & Literature, and Other Humanities.

+Based on total rather than total reports.

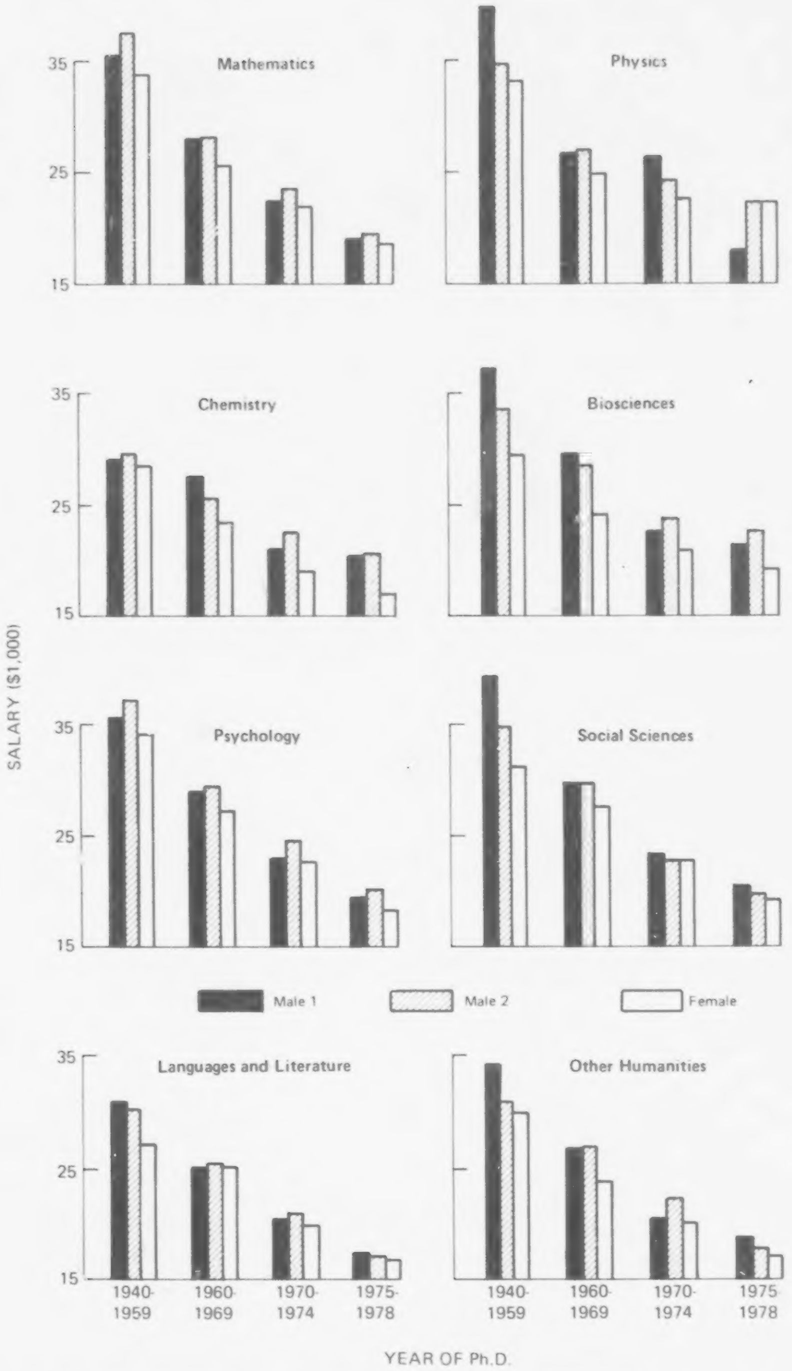

FIGURE 8.1 Comparison of median annual 1979 salaries for two men and one woman in matched triad in research universities by field and cohort

SELECTED BIBLIOGRAPHY OF STUDIES CONCERNING WOMEN IN ACADEME

Astin, Helen S., "Factors Affecting Women's Scholarly Productivity," chapter in *Women in Higher Education: Essays in Honor of Rosemary Park,* Praeger. New York, 1978.

Astin, Helen and Alan Bayer, "Sex Discrimination in Academe," *Educational Record,* Spring, 1972.

Bergmann, B. and M. Maxfield, "How to Analyze the Fairness of Faculty Women's Salaries on Your Own Campus," *AAUP Bulletin,* Autumn 1975.

Cole, Jonathan R., *Fair Science: Women in the Scientific Community,* Free Press, New York, 1979.

Centra, John A., *Women, Men, and the Doctorate,* Educational Testing Service, Princeton, New Jersey, 1974.

Ferber, Marianne, "Economic Status of Women Faculty--Reappraisal," *Journal of Human Resources,* Vol. 13, No. 3, 1978.

Ferber, Marianne, "Sex Differentials in Earnings of Ph.D.s," *Industrial and Labor Relations Review,* Vol. 31, No. 2, 1978.

Ferber, Marianne and Walter McMahon, "Women's Expected Earnings and Their Investment in Higher Education," *Journal of Human Resources,* Summer 1979.

Marwell, Gerald, R. Rosenfeld, and S. Spilerman, "Geographic Constraints on Women's Careers in Academia," *Science,* 9/21/79.

Reagan, Barbara, "Two Supply Curves for Economists? Implications of Mobility and Career Attachment of Women," *American Economic Review,* Vol. 65, No. 2, 1975.

Reagan, Barbara and B. Maynard, "Sex Discrimination in Universities: An Approach Through Internal Labor Market Analysis," *AAUP Bulletin,* Spring 1974.

Scott, Elizabeth L., "Higher Education Salary Evaluation Kit," *AAUP,* 1977.

APPENDICES

A. Questionnaire for the 1979 Survey of Doctorate Recipients

B. Criteria used for selecting matched triads of men and women Ph.D.s

APPENDIX A

1979 SURVEY OF DOCTORATE RECIPIENTS

CONDUCTED BY THE NATIONAL RESEARCH COUNCIL WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION, THE NATIONAL ENDOWMENT FOR THE HUMANITIES, THE NATIONAL INSTITUTES OF HEALTH, AND THE DEPARTMENT OF ENERGY

NOTE: THIS INFORMATION IS SOLICITED UNDER THE AUTHORITY OF THE NATIONAL SCIENCE FOUNDATION ACT OF 1950, AS AMENDED. ALL INFORMATION YOU PROVIDE WILL BE TREATED AS CONFIDENTIAL AND USED FOR STATISTICAL PURPOSES ONLY. INFORMATION WILL BE RELEASED ONLY IN THE FORM OF STATISTICAL SUMMARIES OR IN A FORM WHICH DOES NOT IDENTIFY INFORMATION ABOUT ANY PARTICULAR PERSON. YOUR RESPONSE IS ENTIRELY VOLUNTARY AND YOUR FAILURE TO PROVIDE SOME OR ALL OF THE REQUESTED INFORMATION WILL IN NO WAY ADVERSELY AFFECT YOU.

If your name and address are incorrect, please enter correct information above. Include ZIP Code (79)

If there is an alternate address through which you can always be reached, please provide it on the line below.

C/O Number Street City State ZIP Code (80)

Please check the pre-printed information in questions 1 - 6 to be certain that it is correct and complete.

1. Date of Birth Mo. Day Year (10-14)	2. State or Foreign Country of Birth (15-16)	3. Citizenship 0 ☐ U.S.A. (17) 1 ☐ Non-U.S.A., specify country ______ (18-19)	4. Sex 1 ☐ M 2 ☐ F (20)

5. What is your racial background?
0 ☐ American Indian or Alaskan Native 2 ☐ Black
1 ☐ Asian or Pacific Islander 3 ☐ White
(21)

5a. Is your ethnic heritage Hispanic?
0 ☐ Yes
1 ☐ No
(22)

6. **List in the table below all collegiate and graduate degrees, excluding honorary degrees, that have been awarded to you. Please check the pre-printed information, including the number and name of the specialty, from the Degree and Employment Specialties List on page 4, to be certain it is correct and complete.**

Type of Degree	Granted Mo. Yr.	Major Field (Use Specialties List) Name Number	Institution Name City (or Campus) & State
Bachelor's			
Master's			
Doctorate			
Other, specify			

7. **What is your marital status?** 1 ☐ Married 2 ☐ Not married (including widowed, divorced) (10)
   a. **Do you have any children under 7 years of age?** ☐ Yes ☐ No
   b. **Do you have any children between 7 and 18 years of age?** ☐ Yes ☐ No (11)

8. **Are you physically handicapped?** 0 ☐ Yes 1 ☐ No If YES, enter number(s) from below ______ (12)
   1. Visual 2. Auditory 3. Orthopedic 4. Other, specify ______ (13-16)

9. **How many full-time equivalent years of professional work experience have you had?** ______ Year(s) (17-18)
   a. **How many full-time equivalent years, if any, involved teaching?** ______ Year(s) (19-20)

10. What was your employment status (includes postdoctoral appointment) during the week of FEBRUARY 11, 1979? ☐ Enter number from below (21)

1 Employed full-time
2 Employed part-time
If you were employed part-time, were you seeking full-time employment? ☐ Yes ☐ No (22)
3 Postdoctoral appointment†

†Temporary appointment in academia, industry or government, the primary purpose of which is to provide for continued education or experience in research

If you held a postdoctoral appointment, was it: ☐ Full-time ☐ Part-time (23)

4 Unemployed and seeking employment
5 Not employed and not seeking employment
6 Retired and not employed
7 Other, specify ______________________

If you selected categories 4, 5, or 6 in Question #10, you have completed the questionnaire. Please return this form in the enclosed envelope.

11. From the Degree and Employment Specialties List on page 4 select and enter both the number and title of the employment specialty most closely related to your principal employment or postdoctoral appointment during the week of FEBRUARY 11, 1979. Write in your specialty if it is not on the list.

Number ______ Title of Employment Specialty ______ (24-26)

12. If you were employed full-time during the week of FEBRUARY 11, 1979 in a specialty field other than your field of Ph.D., what was the MOST important reason for being in that position? ☐ Enter number from below (27)

1 Preferred position outside Ph.D. field
2 Promoted out of position in Ph.D. field
3 Better pay
4 Locational factors
5 Position in Ph.D. field not available
6 Other, specify ______________________

13. Please give the name of your principal employer (organization, company, postdoctoral institution, etc. or, if self employed, write "self") and actual place of employment during the week of FEBRUARY 11, 1979.

Name of Employer ______________________ (28-33)

Number ______ Street ______________________

City ______ State ______ ZIP Code ______ (34-38)

14. Which category below best describes the type of organization of your principal employment OR postdoctoral appointment during the week of FEBRUARY 11, 1979? ☐ Enter number from below (39-40)

1 Business or industry (including self-employed)
2 Junior college, 2-year college, technical institute
3 Medical school (including university affiliated hospital or medical center)
4 4 Year college
5 University, other than medical school
6 Elementary or secondary school system
7 Private foundation
8 Museum or historical society
9 Research library or archives
10 Hospital or clinic
11 U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA
12 U.S. government, civilian employee
13 State government
14 Local or other government, specify ______________________
15 Non-profit organization, other than those listed above
16 Other, specify ______________________

15. What percent of your professional work time did you devote to each of the following activities during the week of FEBRUARY 11, 1979?

%

Management & Administration of
1 ______ (41) Research and development
2 ______ (43) Educational programs
3 ______ (45) Other
4 ______ (47) Basic research
5 ______ (49) Applied research
6 ______ (51) Development of equipment, products, systems, data

%

7 ______ (53) Design
8 ______ (55) Teaching
9 ______ (57) Writing, editing
10 ______ (59) Professional services to individuals
11 ______ (61) Consulting
12 ______ (63) Production

%

13 ______ (65) Curatorial work
14 ______ (67) Performing arts
15 ______ (69) Quality control, inspection, testing
16 ______ (71) Sales, marketing, purchasing, estimating
17 ______ (73) Other, specify ______
Total = 100%

a. What were your primary and secondary work activities? (Enter number 1-17 from question #15 above) ☐ Primary (75-76) ☐ Secondary (77-78)

16. What was the basic annual salary* associated with your principal professional employment during the week of FEBRUARY 11, 1979? If you were on a postdoctoral appointment (see question #10 for definition), what was your stipend plus allowances? $ ______________ per year (10-12)

Check whether salary was for ☐ 9-10 months or ☐ 11-12 months (13)

*Basic salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work

17. What was your basic annual salary* for the year ending December 31, 1978? $ ______________ per year (14-16)
Check whether salary was for ☐ 9-10 months or ☐ 11-12 months (17)
a. What was your gross professional income for the year 1978?** $ ______________ (18-20)

**Gross professional income is all payments received for professional activities including basic salary before deductions plus bonuses, consulting fees, honoraria, royalties, rental and subsistence allowances, etc

18. If you were employed by an academic institution during the week of FEBRUARY 11, 1979, did you hold a tenured position? 0 ☐ Yes 1 ☐ No (21)

If **YES**, what year was tenure granted? ________________ (22-23) If **NO**, did you hold a tenure-track position? 0 ☐ Yes 1 ☐ No (24)

19. If you were employed by an academic institution during the week of FEBRUARY 11, 1979, what was the rank of your position? ☐ Enter number from below (25)

FACULTY:

1. Professor
2. Associate professor
3. Assistant professor
4. Instructor
5. Other, specify ________________

NONFACULTY:

6. Teaching staff
7. Research staff
8. Other, specify ________________

20. Was any of your work during the week of FEBRUARY 11, 1979 supported or sponsored by U.S. Government funds?
0 ☐ Yes 1 ☐ No 2 ☐ Don't know (26)

If **YES**, which federal agencies or departments were supporting the work? ________________ (27-60)
(Enter the number(s) from the List of Federal Supporting Agencies on page 4)

21. Listed below are selected topics of critical national interest. If you devoted a proportion of your professional time which you considered significant to any of these problem areas during the week of FEBRUARY 11, 1979, please give the corresponding number of the ONE on which you spent the MOST time.

☐ Enter number from below (61-62)

1. Energy or fuel
2. Health
3. Defense
4. Environ. protection, pollution control
5. Education (other than teaching)
6. Space
7. Crime prevention and control
8. Food and other agricultural products
9. Natural resources, other than fuel or food
10. Community development and services
11. Housing (planning, design, construction)
12. Transportation, communications
13. Cultural life
14. Other area, specify ________________

a. Please enter your BEST estimate of the percent of your professional time during the week of February 11, 1979 that was devoted to this area of national interest.

☐ Enter number from below (63)

1. 100 percent
2. 75 to 99 percent
3. 50 to 74 percent
4. 25 to 49 percent
5. 24 percent or less

If you selected energy or fuel (category #1) in question #21, please provide the information requested in items #22, #23 and #24.

22. From the list below, give the corresponding number of the ONE energy source that involved the LARGEST proportion of your energy-related work during the week of FEBRUARY 11, 1979. ☐ Enter number from below (64)

1. Coal and coal products
2. Petroleum (including oil shale and tar sands) or natural gas
3. Fission
4. Fusion
5. Hydroenergy
6. Direct solar (including space and water heating, thermal, electric)
7. Indirect solar (winds, tides, biomass, etc.)
8. Geothermal
9. Other, specify ________________

23. Please read the following list of energy-related activities and give the corresponding number(s) from the list below of the activity(ies) in which you were engaged during the week of FEBRUARY 11, 1979. Enter number(s) from below ________________ (65-78)

1. Exploration
2. Extraction (gas, oil, mining)
3. Manufacture of energy-related components or products
4. Fuel processing (including refining and enriching)
5. Electric power generation
6. Transportation, transmission, distribution of fuel or energy
7. Energy storage
8. Energy utilization, management
9. Fuel reprocessing or disposal
10. Energy conservation
11. Environmental impact (health, economic, etc.)
12. Education, training
13. Research and development
14. Other, specify ________________

24. Please enter the number 1-14 from item #23 that BEST describes the activity in which you spent MOST of your energy-related time. ☐ (79-80)

Thank you for completing this questionnaire. Please return the completed form in the enclosed envelope to the Commission on Human Resources, JH638, National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418.

DEGREE AND EMPLOYMENT SPECIALTIES LIST

MATHEMATICAL SCIENCES

000 - Algebra
010 - Analysis & Functional Analysis
020 - Geometry
030 - Logic
040 - Number Theory
052 - Probability
055 - Math Statistics (see also 544, 670, 725, 727)
060 - Topology
082 - Operations Research (see also 478)
085 - Applied Mathematics
088 - Combinatorics & Finite Mathematics
091 - Physical Mathematics
098 - Mathematics, General
099 - Mathematics, Other*

COMPUTER SCIENCES

071 - Theory
072 - Software Systems
073 - Hardware Systems
074 - Intelligent Systems
079 - Computer Sciences, Other (see also 437, 476)

PHYSICS & ASTRONOMY

101 - Astronomy
102 - Astrophysics
110 - Atomic & Molecular Physics
120 - Electromagnetism
130 - Mechanics
132 - Acoustics
134 - Fluids
135 - Plasma Physics
136 - Optics
138 - Thermal Physics
140 - Elementary Particles
150 - Nuclear Structure
160 - Solid State
198 - Physics, General
199 - Physics, Other*

CHEMISTRY

200 - Analytical
210 - Inorganic
215 - Synthetic Inorganic & Organometallic
220 - Organic
225 - Synthetic Organic & Natural Products
230 - Nuclear
240 - Physical
245 - Quantum
250 - Theoretical
255 - Structural
260 - Agricultural & Food
265 - Thermodynamics & Material Properties
270 - Pharmaceutical
275 - Polymers
280 - Biochemistry (see also 540)
285 - Chemical Dynamics
298 - Chemistry, General
299 - Chemistry, Other*

EARTH, ENVIRONMENTAL AND MARINE SCIENCES

301 - Mineralogy, Petrology
305 - Geochemistry
310 - Stratigraphy, Sedimentation
320 - Paleontology
330 - Structural Geology
341 - Geophysics (Solid Earth)
350 - Geomorph & Glacial Geology
391 - Applied Geol., Geol Engr & Econ Geol
395 - Fuel Tech & Petrol Engr (see also 479)
360 - Hydrology & Water Resources
370 - Oceanography
397 - Marine Sciences, Other*
381 - Atmospheric Physics & Chemistry
382 - Atmospheric Dynamics
383 - Atmospheric Sciences, Other*
388 - Environmental Sciences, General (see also 480, 528)
389 - Environmental Sciences, Other*
398 - Earth Sciences, General
399 - Earth Sciences, Other*

ENGINEERING

400 - Aeronautical & Astronautical
410 - Agricultural
415 - Biomedical
420 - Civil
430 - Chemical
435 - Ceramic
437 - Computer
440 - Electrical
445 - Electronics
450 - Industrial & Manufacturing
455 - Nuclear
460 - Engineering Mechanics
465 - Engineering Physics
470 - Mechanical
475 - Metallurgy & Phys. Met. Engr
476 - Systems Design & Systems Science (see also 072, 073, 074)
478 - Operations Research (see also 082)
479 - Fuel Technology & Petrol. Engr (see also 395)
480 - Sanitary & Environmental
486 - Mining
487 - Materials Science Engr
498 - Engineering, General
499 - Engineering, Other*

AGRICULTURAL SCIENCES

500 - Agronomy
501 - Agricultural Economics
502 - Animal Husbandry
503 - Food Science & Technology (see also 573)
504 - Fish & Wildlife
505 - Forestry
506 - Horticulture
507 - Soils & Soil Science
510 - Animal Science & Animal Nutrition
511 - Phytopathology
518 - Agriculture, General
519 - Agriculture, Other*

MEDICAL SCIENCES

520 - Medicine & Surgery
522 - Public Health & Epidemiology
523 - Veterinary Medicine
524 - Hospital Administration
526 - Nursing
527 - Parasitology
528 - Environmental Health
534 - Pathology
536 - Pharmacology
537 - Pharmacy
538 - Medical Sciences, General
539 - Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 - Biochemistry (see also 280)
542 - Biophysics
543 - Biomathematics
544 - Biometrics and Biostatistics (see also 055, 670, 725, 727)
545 - Anatomy
546 - Cytology
547 - Embryology
548 - Immunology
550 - Botany
560 - Ecology
562 - Hydrobiology
564 - Microbiology & Bacteriology
566 - Physiology, Animal
567 - Physiology, Plant
569 - Zoology
570 - Genetics
571 - Entomology
572 - Molecular Biology
573 - Food Science & Technology (see also 503)
574 - Behavior/Ethology
576 - Nutrition & Dietetics
578 - Biological Sciences, General
579 - Biological Sciences, Other*

PSYCHOLOGY

600 - Clinical
610 - Counseling & Guidance
620 - Developmental & Gerontological
630 - Educational
635 - School Psychology
641 - Experimental
642 - Comparative
643 - Physiological
650 - Industrial & Personnel
660 - Personality
670 - Psychometrics (see also 055, 544, 725, 727)
680 - Social
698 - Psychology, General
699 - Psychology, Other*

SOCIAL SCIENCES

700 - Anthropology
703 - Archeology
708 - Communications*
709 - Linguistics
710 - Sociology
720 - Economics (see also 501)
725 - Econometrics (see also 055, 544, 670, 727)
727 - Social Statistics (see also 055, 544, 670, 725)
740 - Geography
745 - Area Studies*
751 - Political Science
752 - Public Administration
755 - International Relations
770 - Urban & Regional Planning
775 - History & Philosophy of Science
798 - Social Sciences, General
799 - Social Sciences, Other*

HUMANITIES

802 - History & Criticism of Art
804 - History, American
805 - History, European
806 - History, Other*
808 - American Studies
809 - Theater & Theater Criticism
830 - Music
831 - Speech as a Dramatic Art (see also 885)
833 - Religion (see also 881)
834 - Philosophy
836 - Comparative Literature
891 - Library & Archival Sciences
878 - Humanities, General
879 - Humanities, Other*

LANGUAGES & LITERATURE

811 - American
812 - English
821 - German
822 - Russian
823 - French
824 - Spanish & Portuguese
826 - Italian
827 - Classical*
829 - Other Languages*

EDUCATION & OTHER PROFESSIONAL FIELDS

801 - Art, Applied
881 - Theology (see also 833)
882 - Business Administration
883 - Home Economics
884 - Journalism
885 - Speech & Hearing Sciences (see also 831)
886 - Law, Jurisprudence
887 - Social Work
897 - Professional Field, Other*
899 - Other Fields*

938 - Education (other than teaching in a field listed above)

*Identify the specific field in the space on the questionnaire

LIST OF FEDERAL SUPPORTING AGENCIES (For use with #20)

1. Agency for International Development
2. Environmental Protection Agency
3. National Aeronautics & Space Administration
4. National Endowment for the Arts
5. National Endowment for the Humanities
6. National Science Foundation
7. Nuclear Regulatory Commission
8. Smithsonian Institution
9. Department of Agriculture
10. Department of Commerce
11. Department of Defense
12. Department of Energy
13. National Institutes of Health (DHEW)
14. Alcohol, Drug Abuse & Mental Health Administration (DHEW)
15. National Institute of Education (DHEW)
16. Office of Education (DHEW)
17. Other DHEW, specify ______________________
18. Department of Housing and Urban Development
19. Department of the Interior
20. Department of Justice
21. Department of Labor
22. Department of State
23. Department of Transportation
24. Other agency or department, specify ______________________
25. Don't know source agency

APPENDIX B

CRITERIA USED FOR SELECTING
MATCHED TRIADS OF MEN AND WOMEN PH.D.S

GENERAL MATCHING CRITERIA

a. Categories for matching by Roose-Andersen rating of Ph.D. department
   (1) 4.0 - 5.0
   (2) 3.0 - 3.9
   (3) 2.5 - 2.9
   (4) 2.0 - 2.4
   (5) 1.0 - 1.9

b. Broad field of doctorate
   (01) Math
   (02) Computer sciences
   (03) Physics
   (04) Chemistry
   (05) Earth sciences
   (06) Engineering
   (07) Agriculture
   (08) Medical
   (09) Biological
   (10) Psychology
   (11) Social sciences
   (12) Languages/lit
   (13) Other humanities

c. Categories for matching by race (cases with unknown race should not be matched)
   (1) White
   (2) Asian
   (3) Black
   (4) Other

d. Allowable difference in year of doctorate:

1970 - 1978	± 1 year
1960 - 1969	± 2 years
1950 - 1959	± 3 years
1940 - 1949	± 5 years

*permit matches across decade

TABLE B.1 Number of matched pairs and matched triads of men and women doctorates in sample

Characteristics of the females in the matched triad or pair	Number of "A" Matched Triads	Number of "A" Matched Pairs by Cohort				Number of "B" Matched Triads	Number of "B" Matched Pairs in Academe by Cohort				No. of Broken "B" Triads in Rank Regression+ 1958-1978 cohort		No. of Broken "B" Triads in Salary Regression** 1958-1978 cohort	
	general matching criteria*	1940-1959	1960-1969	1970-1974	1975-1978	(A) + same empl. sector, experience	1940-1959	1960-1969	1970-1974	1975-1978	Women	Men	Women	Men
Total	5,164					3,083	406	893	711	674	373	833	324	780
							(all years = 2,634)							
Year of doctorate														
1940-1949	1,119													
1950-1959	1,512													
1960-1969	1,288													
1970-1978	1,245													
Field of doctorate++														
Mathematics	390	82	136	95	77	244	42	101	56	54				
Physics	363	78	97	94	94	206	24	50	47	38				
Chemistry	541	134	162	124	121	329	30	65	40	45	94	195	79	175
Earth Sciences	161	31	37	41	52	67	6	10	19	19				
Engineering	128	10	30	36	52	61	4	11	10	14				
Medical Sciences	183	22	52	51	58	56	7	21	22	31	126	332	107	315
Biological Sciences	1,190	256	347	291	296	799	93	183	172	178				
Psychology	531	151	155	121	104	337	48	81	49	38	100	162	92	152
Social Sciences	547	141	171	128	107	309	58	129	77	68				
Languages/Lit.	482	84	135	137	126	320	46	110	100	85	53	144	46	138
Other Humanities	648	130	190	170	158	356	48	133	119	104				
Employment sector														
Academe	n/a					2,138								
Business/industry	"					332								
Federal govt.	"					85								
Other employer/ not employed	"					528								

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*As described on page 94.

+Regression analyses of faculty rank included 1958-1978 Ph.D.s who were faculty at Research Universities I (a Carnegie classification which includes 51 institutions), and for whom the appropriate demographic and employment information was available.

**Regression analyses of faculty salaries were further restricted to those who were full-time employed and reported salary.

++The fields of computer sciences and agricultural sciences, for which Roose-Andersen ratings of Ph.D. departments are not available, were excluded.